

Biggest Automobile Show Part of New York World's Fair

By HERBERT HOSKING

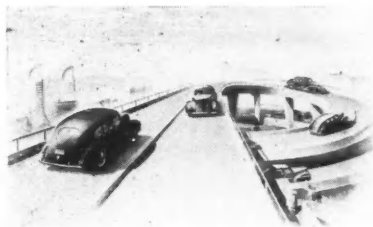
ON Sunday, April 30, the center of the automotive industry moved temporarily from Detroit to World's Fair, New York; a post office in the middle of a former swamp, but now surrounded by the largest and most amazing collection of gimmicks gathered since the beginning of show business.

To New York World's Fair 1939, Inc., the automotive industry, led by General Motors, Chrysler and Ford, and flanked by a score of parts and accessory manufacturers, glass and rubber companies, has paid . . . a figure which isn't being divulged, either by the Fair corporation or by individual exhibitors.

This is being written within a week of the official opening date of the Fair. A correspondent who has been camping on the ground reported that day and night work would be necessary to put many of the exhibits in shape for opening. Recumbent statues await the settlement of union squabbles on priority, before they can be raised to dominate the inevitable courtyards. Telephone calls directly to Fair headquarters reflect a little of the mad hammering and sawing which accompanies the final days of preparation.

Alone of automotive exhibits, the General Motors "Futurama" was ready a couple of weeks in advance of opening; ready in time for a number of previews. There was one on April 18 for industrial leaders and one on April 19 for the press. Prior to the previews, Alfred P. Sloan, Jr., chairman of General Motors, telegraphed hundreds of industrialists for statements on what their company's research programs had contributed to progress in the last five years.

Said Mr. Sloan in his questionnaire: "It seems to me highly desirable for industry to promote a broader understanding at this time of the advancements being made through bringing out new and significant product developments."



Detail of the Ford Motor Co. Exhibit

EXHIBITORS at the New York World's Fair divide into three classes; those who have exhibits in their own buildings, those who have space in other buildings, and those who share in a group promotion by an industry, a concessionaire, or the Fair itself. The automotive industry is represented heavily in all departments, and is occupying most of the largest units in the ground plan. It's an automotive Fair!

An avalanche of replies indicate the agreement of other industrialists with Mr. Sloan's statement, and furnish an amazing and significant panorama of what industrial research has contributed to the national welfare within the past five years.

From the hundreds of replies released for publication we have taken those of automotive interest, which as a unit show the complicated interrelationships of the industry, and the dependence of even the largest manufacturers of motor vehicles of research in scattered independent plants making parts, accessories, and components.

Speaking of Automotive Progress:

Executives throughout the automotive industry and its allied interests replied to Mr. Sloan:

MAX W. BABB, president, Allis-Chalmers Mfg. Co.

Allis-Chalmers Mfg. Co. introduces in 1939 a one-man operated harvesting machine, that in a single operation cuts, threshes, separates, cleans and bins more than one hundred different varieties of grains, beans and seeds ranging in size from the red kidney and baby lima beans down to bird seeds, at a labor cost of one-man hour per acre when harvesting com-

mercial grains, that is of economic significance.

ARTHUR V. DAVIS, chairman, Aluminum Co. of America.

Aluminum is helping to supply more efficient, economical and speedy transportation facilities. The recent trans-Atlantic flight of the American Clipper, the largest commercial passenger-carrying aircraft ever conceived, is an example of our progress in this direction. The new train of the Brooklyn-Manhattan Transit Co. is another example.

H. W. PRENTIS, JR., president, Armstrong Cork Co.

We mention our conception of and research on materials combining insulating and refractory qualities. Resulting products have made possible use of higher temperatures in metallurgical and oil industries, thus helping to bring to consumer alloy steels, oils and gasoline at more acceptable prices. Other recent developments are special damping material to improve quiet and comfort of all-steel automobile bodies.

GEORGE BAEKELAND, vice-president, Bakelite Corp.

Recent developments of synthetic bonds for plywoods will, in our opinion, contribute toward greater economy in construction of . . . airplanes . . . boats and parts of automobile bodies. New improvements in synthetic resins for paints and varnishes will reduce drying time, thus cutting finishing costs, and added durability will result in considerable savings to manufacturers and consumers.

CHESTER H. LEHMAN, vice-chairman of board, Blaw-Knox Co.

Trukmixers, a product recently developed by the construction equipment department of the Blaw-Knox Co., have, in our opinion, given many more men employment than in the past for the volume of concrete placed. This unit mixes the concrete in transit from a point of central charging to the destination.

M. H. EISENHART, president, Bausch & Lomb Optical Co.

Believe an outstanding Bausch & Lomb contribution is the multiplex projector, an apparatus for projecting stereoscopically aerial photographs in

such a way that contour topographic maps can be made with much greater speed than with ground surveys.

EUGENE G. GRACE, president, Bethlehem Steel Corp.

One of the most outstanding developments in the steel industry, to which all of the major sheet producers have contributed, has been the development of high quality deep-drawn steel sheets which have made possible the fender and the all-steel top of the modern automobile.

WHIPPLE JACOBS, vice-president, Belden Mfg. Co.

We are just introducing fibreglas, insulated high-tension wires for internal combustion engines, and believe this a definite contribution to the motor truck and bus industry.

C. L. EGTVEDT, president, Boeing Airplane Co.

Since previous preview of progress, this company has developed four motored airplanes for military and commercial uses. The military planes by South American flights have demonstrated effectiveness and reliability as defensive instruments. The clipper boats establish new standards of speed, comfort and capacity for trans-oceanic transport. Research now in process for development of high altitude transport planes, with cabins designed to furnish atmospheric pressure for comfort of crew and passengers, gives promise of early progress to point of commercial utilization.

EDWARD G. BUDD, president, Edward G. Budd Mfg. Co.

In answer to your inquiry, I am pleased to submit the following:

Development of a method of fabrication for large structures, using high alloyed steels, in which the high qualities are attained by means other than heat treatment, and the application of this technique to the building of railway cars and airplane structures. Design of brake for railway cars. Method of hardening the interior surfaces of cylinders.

E. P. BULLARD, president, The Bullard Co.

One of the more significant and consistent contributions to the economic welfare of the nation and industrial progress is the constant development (Turn to page 588)

The Brass-Hat Rack



"But, Mr. Whalen, they let Citroen advertise his car on the Eiffel tower!"

BUSINESS IN BRIEF

*Our own view of automotive production and sales;
authoritative interpretation of general conditions*

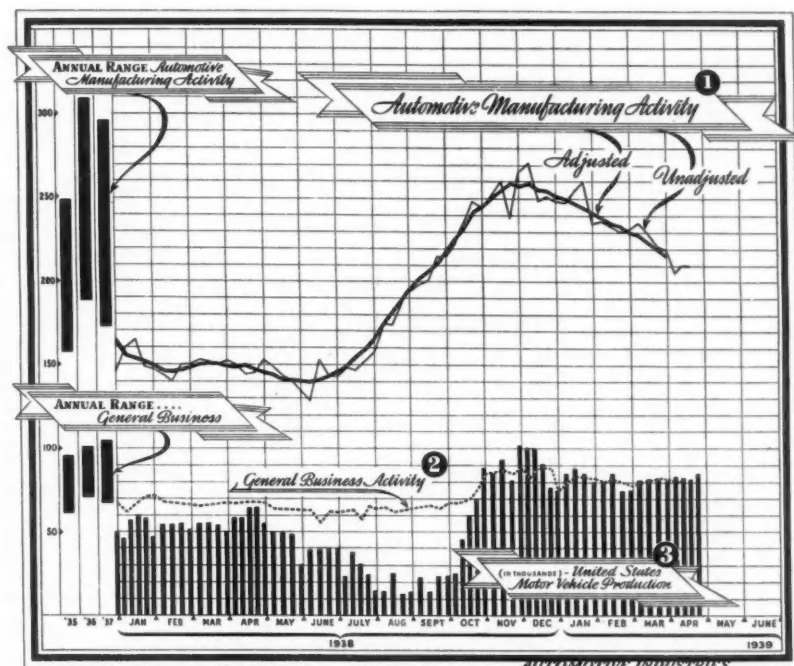
PRODUCTION schedules of car and truck manufacturers for May will start on approximately the same basis as that prevailing throughout most of April, according to preliminary estimates made by J. A. Laansma, Detroit News Editor of AUTOMOTIVE INDUSTRIES. Sales figures for the last 10 days in April are expected to play an important part in determining rate of operations.

Output for the last week in April was expected to total approximately 85,000 cars and trucks, a mark near which production hovered throughout the month, and which was expected to bring the total production estimate for the month to approximately 340,000 units.

Because this represents a slight decline from March production, industry observers were more inclined to compare it with March, 1938, when 238,597 cars and trucks were turned out. It is pointed out that during the first two quarters of production on 1939 models the industry was proceeding at the rate of a four million car year which seems now to exceed the year's market possibilities. As a result there has had to be some tapering off in order to keep output more directly in line with anticipated sales.

Manufacturers expected to begin the month of May with field stocks in excellent condition, from the standpoint of both new and used inventories, and with production facilities ready to respond to any increased needs dictated by sales experience. Best estimates, however, were that there would be little change in

¹ 1923 average = 100; ² Prepared by Administrative and Research Corp., New York. 1926 = 100; ³ Estimated by J. A. Laansma, Detroit News Editor, AUTOMOTIVE INDUSTRIES.



Weekly indexes of automotive and general business charted

Business Holds Steady at April Levels

output during the early weeks in May.

AUTOMOTIVE MANUFACTURING ACTIVITY for the week ending April 22 preserved the level of the unadjusted index at 210, the same figure reported for the preceding week. Downward movement of the adjusted curve (which records the general trend), continued with this index falling off to 216, four points below the mark recorded for the week ended March 25.

Regular readers of this chart will note that several changes, comprising one deletion and two additions, have been made. Plotting of the unadjusted Federal Reserve figures of U. S. monthly production of passenger cars has been discontinued. The additions include vertical line indicators of weekly output of U. S. manufacturers of cars and trucks, estimated by our Detroit News Editor, and a dotted line charting the weekly index of general business activity prepared by the Administrative and Research Corp., New York.

GENERAL BUSINESS ACTIVITY for the week ended April 22, according to the Guaranty Trust Company of New York, was characterized by "apparent steadiness." The index of the *Journal of Commerce* for the week ended April 15 rose half a point to 79.9, as against 70.2 a year ago.

Railway freight loadings increased 2.3 per cent in the week ended April 15, reversing the sharp downward trend occasioned by the interruption of coal mining at the beginning of the month, and were 1.9 per cent above the loadings a year ago.

Bituminous coal production during that week averaged (Turn to page 561, please)

BUSINESS ACTIVITY

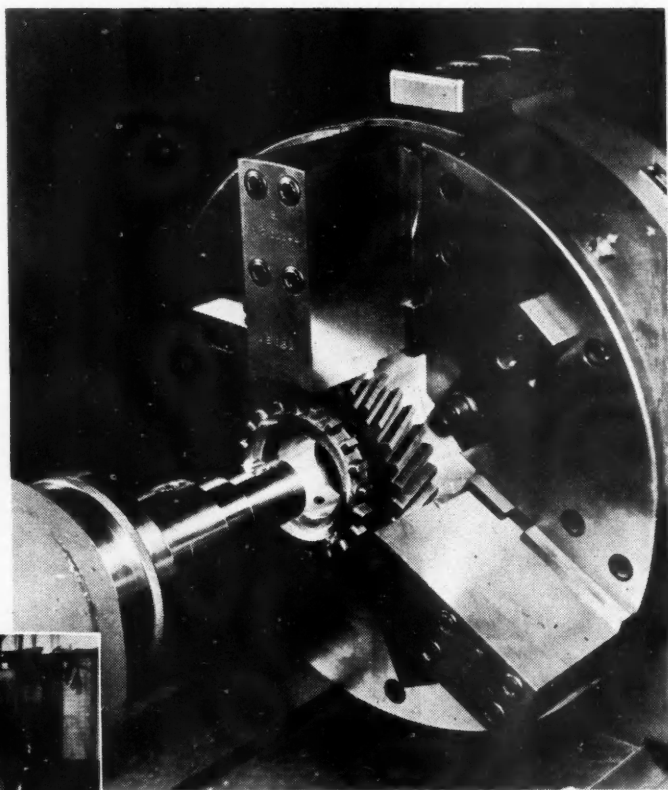
Economy and

Paramount issue in Fuller manufacturing program supplying 88 transmission users

By JOSEPH GESCHELIN

THAT the building of a line of high quality transmissions for heavy-duty service abounds in knotty problems of engineering and manufacturing can be appreciated when one studies the business of the Fuller Manufacturing Co., Kalamazoo, Mich.

Organized in 1902 as the Michigan Automobile Co. to manufacture the "Michigan" car, the company was equipped to build the car completely in all of its components. With the rapid expansion of the automobile industry and the demand for independent sources of supply for component units of cars, the company decided to abandon the manufacture of automobiles and to concentrate upon the production of clutches and transmissions.



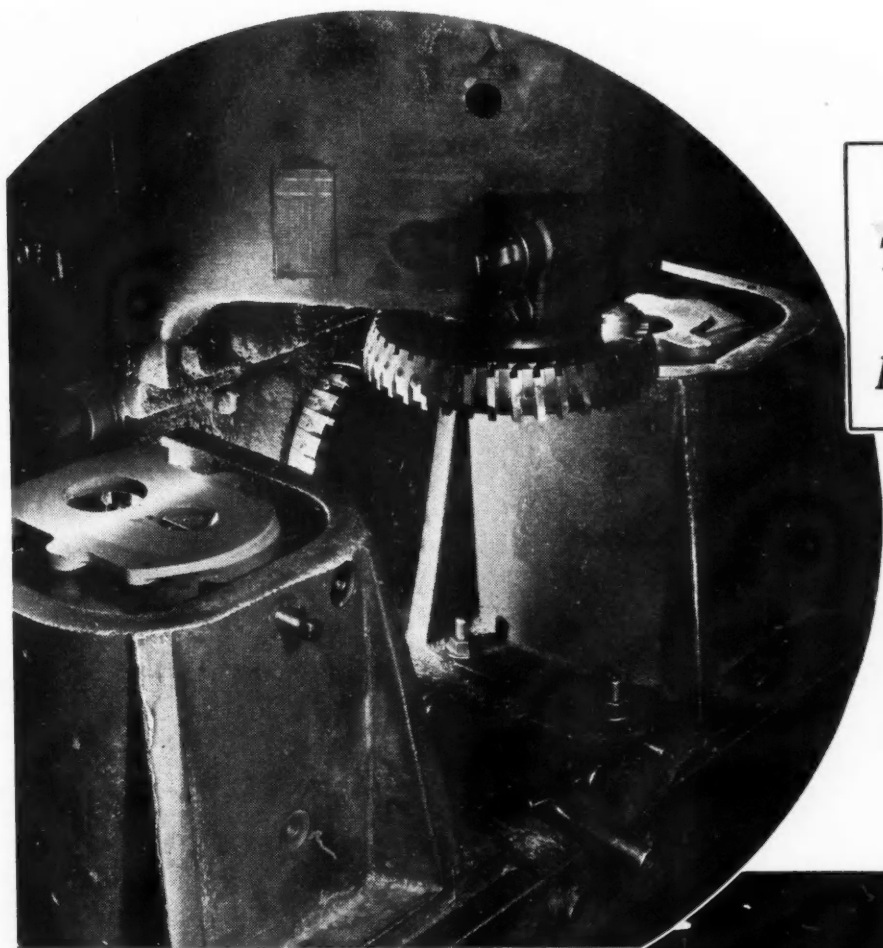
Close-up of work station of new Heald Borematic installed in the gear department for boring gears and other transmission elements. This view shows in excellent fashion the detail of the work-holding chuck with its three, quickly replaceable jaws, for accommodating the entire gamut of gears processed on the machine.



At first there was little distinction between equipment for passenger cars and trucks. Later, the two branched out into entirely different types of units and Fuller began to lean more heavily on the motor truck side of the picture. The last large quantity order for passenger car transmis-

Perspective of portion of the transmission final assembly line, bending around three sides of the parts storage department in background at the right. Component parts are fed to the line from this source.

Varied Requirements



*This is the
Thirty-seventh in the
series of monthly
production features*

Typical set-up on Ingersoll for transmission case milling in keeping with multiple-lot production economy. Note the two fixtures on the table, holding two cases, permitting an operator to finish two at a time by moving the work progressively from one fixture to the other. Large milling cutters such as are used for this operation are tipped with Stellite J-metal tools.

sions was completed in 1923 and from that date on, Fuller has specialized in heavy-duty units exclusively.

As this article was written, the record indicated that the company is catering to no less than 88 different organizations in the automotive field, not including an imposing list of names in other, perhaps unrelated industries.

With this picture in view, it may be appreciated that while herculean efforts are made to effect some measure of interchangeability in the interest of cost economy, the very nature of the business demands almost individual attention to

One of the two large, horizontal, hydraulic Oilgear broaching machines used for gear blank bore broaching operations.

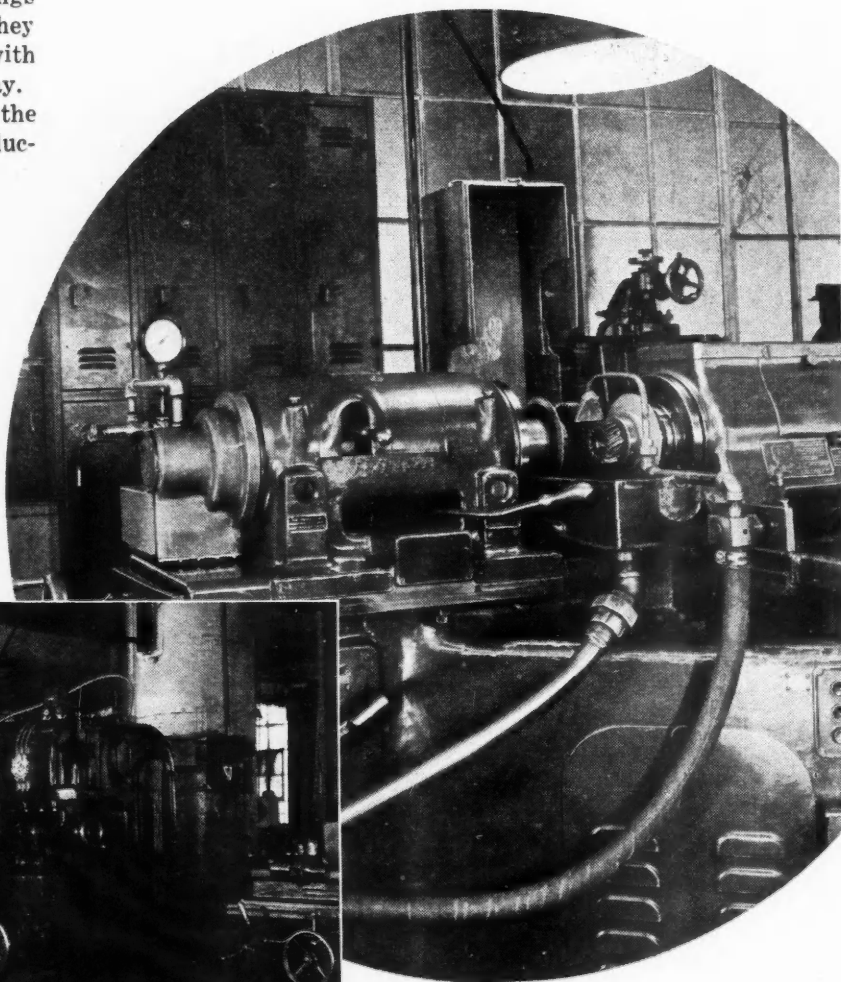


the requirements of each customer. Nevertheless, cost economy is achieved. How this is done, how gear design is bent to suit a limited range of gear tooling, provides an interesting commentary on the flexibility and resourcefulness of the organization. All this will be discussed later. Suffice it to say for the moment that apart from the many variations in gearing, the current line of transmissions comprehends some 300 variations from the catalog product and includes some 50 or more different transmission cases.

It may not be generally known that this company is composed of three separate manufacturing units. First is the home plant at Kalamazoo where all manufacturing is centered. It comprises 115,370 sq. ft. of productive floor space in the machine shops, modernized gear department, assembly, etc. On the same premises is a moderate sized foundry catering to the multiple-lot needs of the business. It is equipped to produce all of the variety of gray iron and alloy castings in a floor space of some 10,000 sq. ft. They pour around nine tons per day normally, with maximum capacity of about 12 tons per day.

The third unit is the forge division, the Unit Drop Forge, Milwaukee, Wis., producing forgings for Kalamazoo as well as for other customers. This small but busy establishment supplies the gear

(Right) Close-up of one of the two Gleason lapping machines, fitted specially for the lapping of Fuller transmission gears after heat treatment. View taken with gear cover removed, showing method of flowing lapping compound on gear train. Note the lapping compound circulatory pump at left front corner of machine, also large diameter pipe line leading from compound sump under gears, through spreader funnel, back to pump.



(Left) Initial battery of two of the latest type rotary cutter Michigan Tool shaving machines which are used for correcting all gears prior to heat treatment. Norton grinder at the right is used for grinding the gear O.D. prior to the shaving operation.

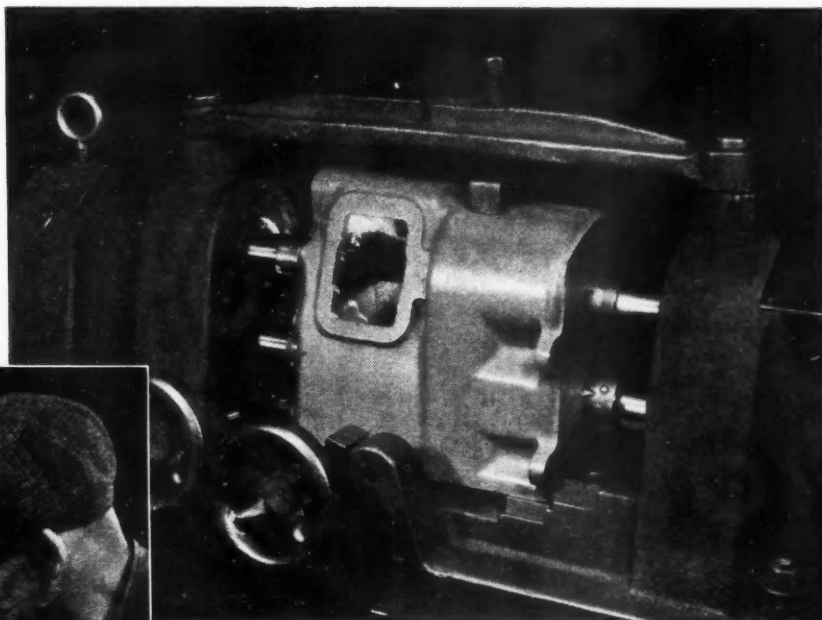
Fuller Manufacturing Co. Factory Executives

J. Seton Gray
E. L. Ludvigsen

C. C. MacDowell
R. B. World
C. A. Cook
Sam Trimbath
J. K. Gensler
M. E. Jackson
M. F. Payne
A. J. Edgar
George Garn

President
Vice-President & General
Manager
Factory Manager
Purchasing Agent
Chief Engineer
Gear Engineer
Superintendent
Production Manager
Chief Inspector
Foundry Superintendent
Factory Manager of Forge
Division

(Right) Close-up of work station on W. F. & John Barnes horizontal boring machine set up for line boring transmission case.



(Below) Close-up of work station on a Lo-Swing lathe used for turning transmission shafts.



These transmissions are designed to give efficient and long-lived service on motor trucks, buses, tractors, special "off-the-highway" transport equipment, industrial equipment of every description. And right at this point, we wish to accent the fact that "quietness," the hall-mark of modern passenger car transmissions, is a very much demanded quality in the heavy-duty gear boxes. If that is not sufficient novelty, consider that in the opinion of Fuller people their big transmissions must have a degree of quiet-

(Turn to page 559, please)

blanks, shifter forks, gear shift levers, and other miscellaneous forgings required in transmission production.

Among the basic units in the Fuller line of transmissions are the following:

5-speed unit transmission for 2-2½ ton trucks.

5-speed unit transmission for medium heavy-duty trucks and tractors.

5-speed unit transmission for heavy-duty trucks and buses.

Large 4-speed unit transmission for extra heavy duty.

Large 8-speed unit-type transmission for extra heavy duty.

Unit-type reversing transmission.

Unit-type, 2-speed transmission.

2-speed auxiliaries.

3-speed auxiliary.

Full-line amidship units comparable to the unit-type gear boxes noted above.

Factory Routing First Speed Sliding Gear

OPERATION	EQUIPMENT
Drill	Moline Hole Hog drill press
Round broach	Oilgear horizontal broach
Spline broach	Oilgear horizontal broach
Rough and finish turn and finish yoke slot	Fay automatic lathe
Face off hub to length	Muller engine lathe
Countersink and ream	Aurora drill press
Rough and finish hob teeth, one operation (2 gears at a time)	Barber Colman hobber—Type A
Shave and green grind outside diameter	Michigan Tool shaving machine and Norton grinder
Wash	Niven washer
Wire brush outside diameter after shave	Challenge emery wheel stand
Chamfer (both sides)	Peerless Chamfering machine
Burnish spline	Atlas Power Press No. 55
File all burrs	Bench
Wash	Niven washer
Heat treat	Carburize
Grind hole	Heald Gage-Matic grinder
Wash	Crescent washer

Versatility marks



General view of a corner of the sheet metal department devoted to hand operations on the forming of fan shrouds. Among the equipment are items of special machinery for producing a wide variety of multiple-lot parts

View of two lines of punch presses for various multiple-lot operations; two additional lines at the extreme left handle similar work. Equipment ranges from No. 4 Loshbaugh & Jordan presses for medium work, to No. 104 and No. 105 Bliss and Consolidated presses in the background



CATERING to the technical needs of no less than 78 different organizations in the automotive field alone, the Young Radiator Co., Racine, Wis., is an outstanding example of the versatility of independent parts producers.

Specializing for over a decade in the development and manufacture of heat transfer systems, this company centers the bulk of its automotive activity in cooling systems for heavy-duty applications—buses, motor trucks, railcars, racing cars, Diesel engines, industrial and stationary equipment of every description. How varied the product really is, may be gaged from the estimate that the company makes as many as 1000 different types of radiators, alone, during the course of a year's production.

Couple this variety with the relatively small unit volume per order and you have a manufacturing situation which can be met economically only by an organization that is flexible in its every joint. Nor is this the complete statement of the problem, since as a matter of fact, cooling systems form but a part of the complete line.

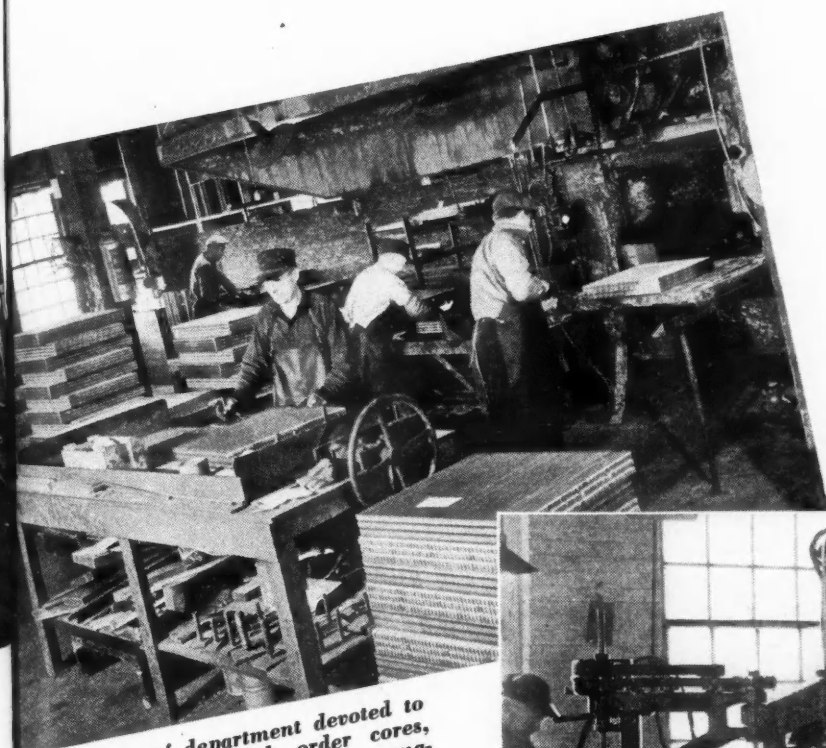
The company shares with other outstanding parts makers who command the respect of the industry, the common attribute of intelligent service well rounded in every respect. It includes engineering, fundamental and product research, design planning, new development to further advances in the art. For this purpose, Young operates an extensive engineering department and a research department employing wind tunnel equipment and instrumentation unique in an operation of its size.

Manufacturing facilities center in a commodious plant comprising some 200,000 sq. ft. of productive floor space. Since flexibility is a dominant quality of the operation, production departments are equipped with universal types of machinery serviced by a wide range of jigs and fixtures capable of quick changeover from one product or part to another.

Needless to say, such an operation demands skilled

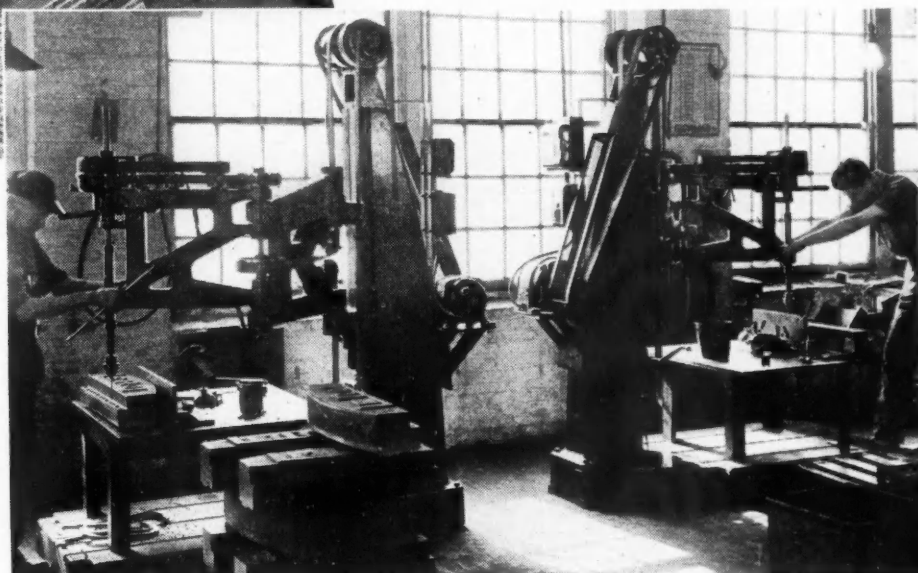
Young's Production

Small volume, part order with large production and a range of 1000 styles has developed a technique of unusual flexibility with universal type of machinery



Corner of the busy machine shop with two of the battery of versatile Hammond radial drills which are used for a variety of drilling and tapping operations. Skilled operators are provided with metal plate jugs to facilitate the work and provide accuracy

Corner of department devoted to fabrication of job order cores, featuring a fusion bonding machine operated by heated air provided with blowers which force air circulation through the core



workers who can accommodate themselves to changes in product, to changes in set-up at frequent intervals. Too, the universal types of machines require more skill and experience on the part of the operators that are employed.

Now just a brief comment on the variety of products handled by the company. Among the high-spots are—radiators, oil coolers, engine jacket water coolers, condensers, blast coils, factory type space unit heaters, convection heaters, car heaters, heat transfer surfaces for air conditioning and special applications, space coolers, and many other special items. Despite the

variety, all of the items produced here belong to the same generic family—heat transfer units—and thus fit well into the pattern of engineering and research facilities.

Due to the gamut of specialized skills harnessed in a plant of this character, the best that we can do is to provide a general perspective by high-spotting at strategic points. In fact, we shall have to rely upon

the pictorial section to carry the burden of the presentation.

Manufacturing facilities necessarily are most complete since every element of the product is fabricated on the premises from basic raw materials. Among the self-contained departments are the following: Complete department for tool and die making, press shop, sheet metal forming, machine shop, solder processing, testing tanks and equipment, metal finishing, final assembly. As the illustrations show, most of the equipment is, of necessity, of universal type, although there are many items of equipment unique to the type of work done here that were designed and built specifically for the purpose.

Press equipment ranges from large forming presses for drawing radiator shells to the small inclinable presses for punching small parts. The latter are all fitted with ingenious progressive dies, fed by a novel form of automatic feed

Executive Personnel of Young Radiator Co.

F. M. Young.....	President and General Manager
W. H. Schleck.....	Secretary-Treasurer
J. M. Mueller.....	Auditor
J. J. Hilt.....	Vice-Pres. Sales, Contract Products Div.
M. F. May.....	Vice-Pres. Sales, Catalog Products Div.
R. W. Baggott.....	Purchasing Agent
E. C. Thorson.....	Comptroller
W. V. Astrup.....	Chief Engineer
S. K. Andersen.....	Research Engineer
D. W. Christensen.....	Chief Draftsman
L. C. Pfost.....	Works Manager
H. C. Schultz.....	Assistant Superintendent
O. M. Maisch.....	Assistant Superintendent
H. M. Hansen.....	Production Manager
P. F. Brinen.....	Chief Inspector
J. Alperovitz.....	Planning Department

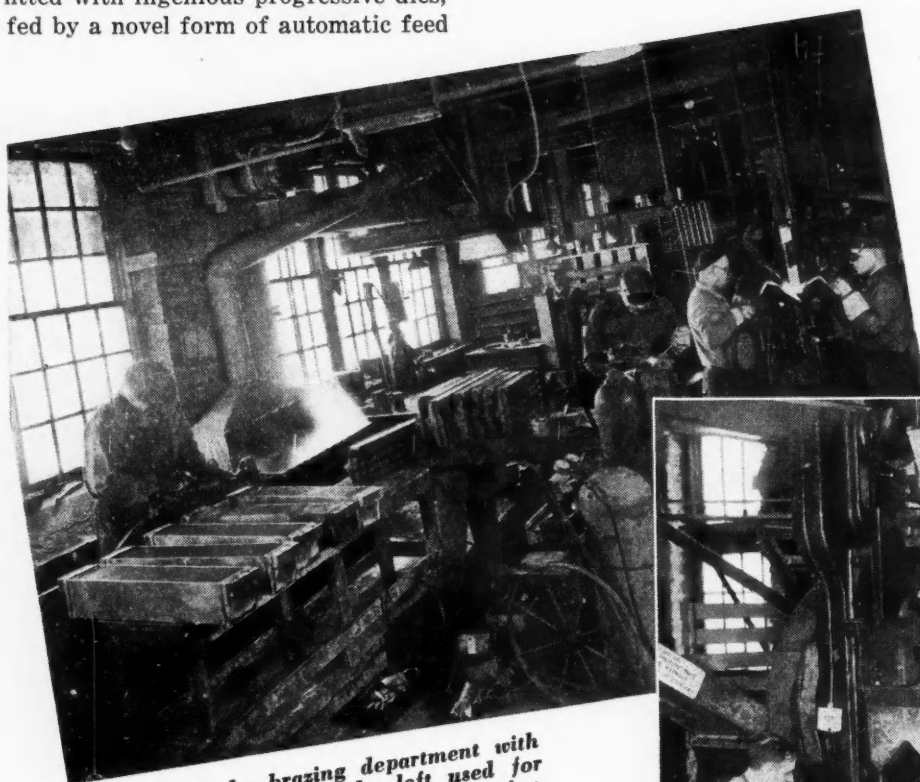
roll. The feed device is so designed as to provide a controlled slack of the sheet metal strip, permitting a uniform movement of work through the dies without imposing shock or strain.

Sheet metal forming is handled in a business-like manner. Every job in the plant is made to master templates which are stored in the department, identified according to part number.

In the machine shop are found the conventional types of metal cutting equipment—milling machines, lathes, grinders, radial drills for handling the bulk of production drilling and tapping. Suitable jigs and fixtures are provided for every casting processed in this department to facilitate handling and aid in quality control.

In addition to the foregoing, there is special equipment manned by craftsmen skilled in the art of brazing, soldering, and welding so essential in this type of work.

While, in the main, it is rather

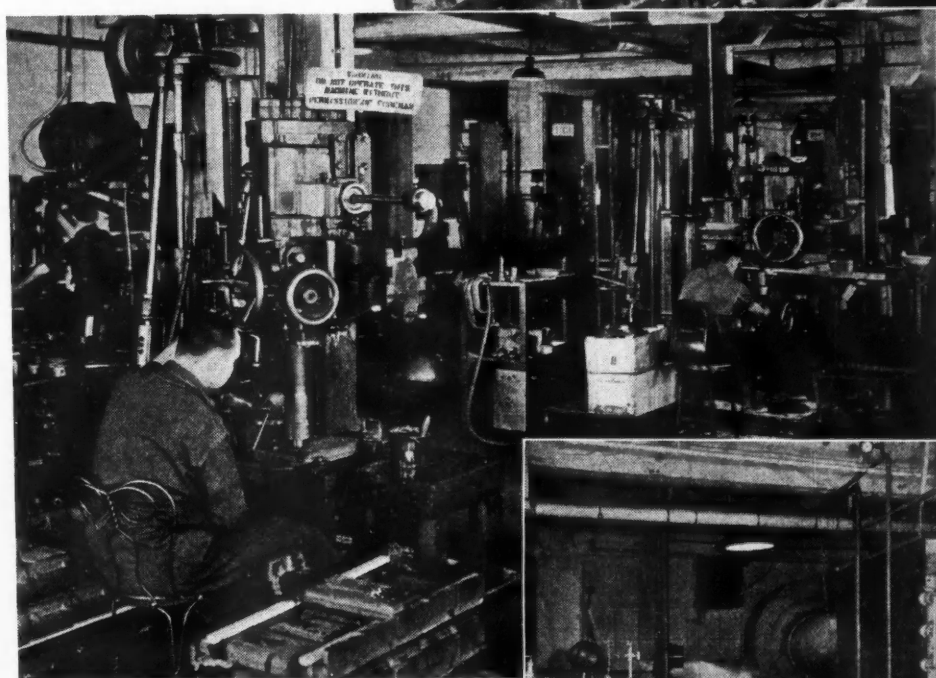
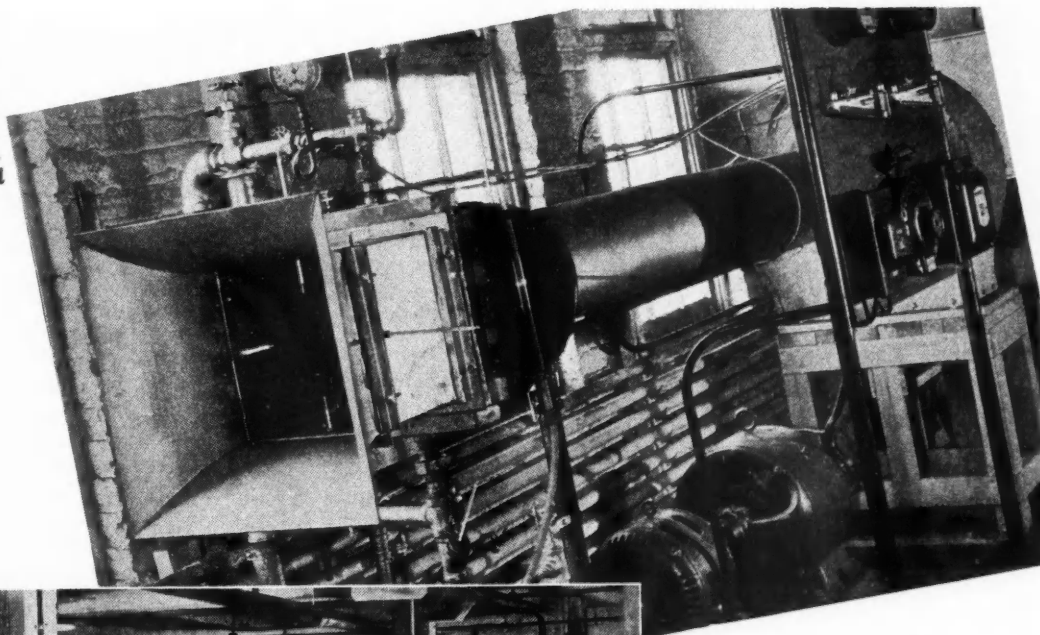


A corner of the brazing department with a patented machine at the left used for fusion bonding of a header to a core section. The machine is fitted with torches which automatically extinguish when hung up; ignite when lifted. Cleaning and oxy-acetylene torch operations may be seen at the right

Large Toledo press for forming and drawing operations, fitted with Marquette air cushions for double-acting cycle

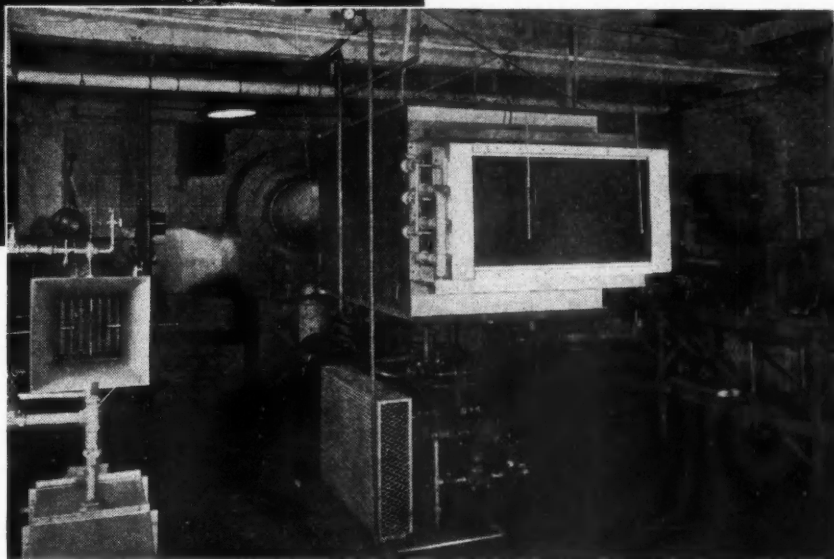


Close-up of small wind-tunnel set-up for testing small standard test cores of 12 in. x 12 in. size. Seen here are the blower, tunnel with its blower, motor generator set, instrument control panel



General view of forward end of the Young research laboratory with the small wind tunnel equipment at the left. The large unit in the center is designed for large cores and cooling coils and is equipped with a refrigerating machine for testing such items

Another section of the machine shop, showing a number of Western Radial drills for heavy boring and tapping operations



difficult to describe all of the ramifications of the process in various departments, there is one real mass production line that lends itself to concrete and detailed treatment. This is the outstanding department for the manufacture of a special line of car heaters. Here again the story is best told by the illustrations. Referring to the pictorial section, there is an example of one of the small press set-ups for producing the fin stamping. It is fitted with a progressive die and is entirely automatic in every respect.

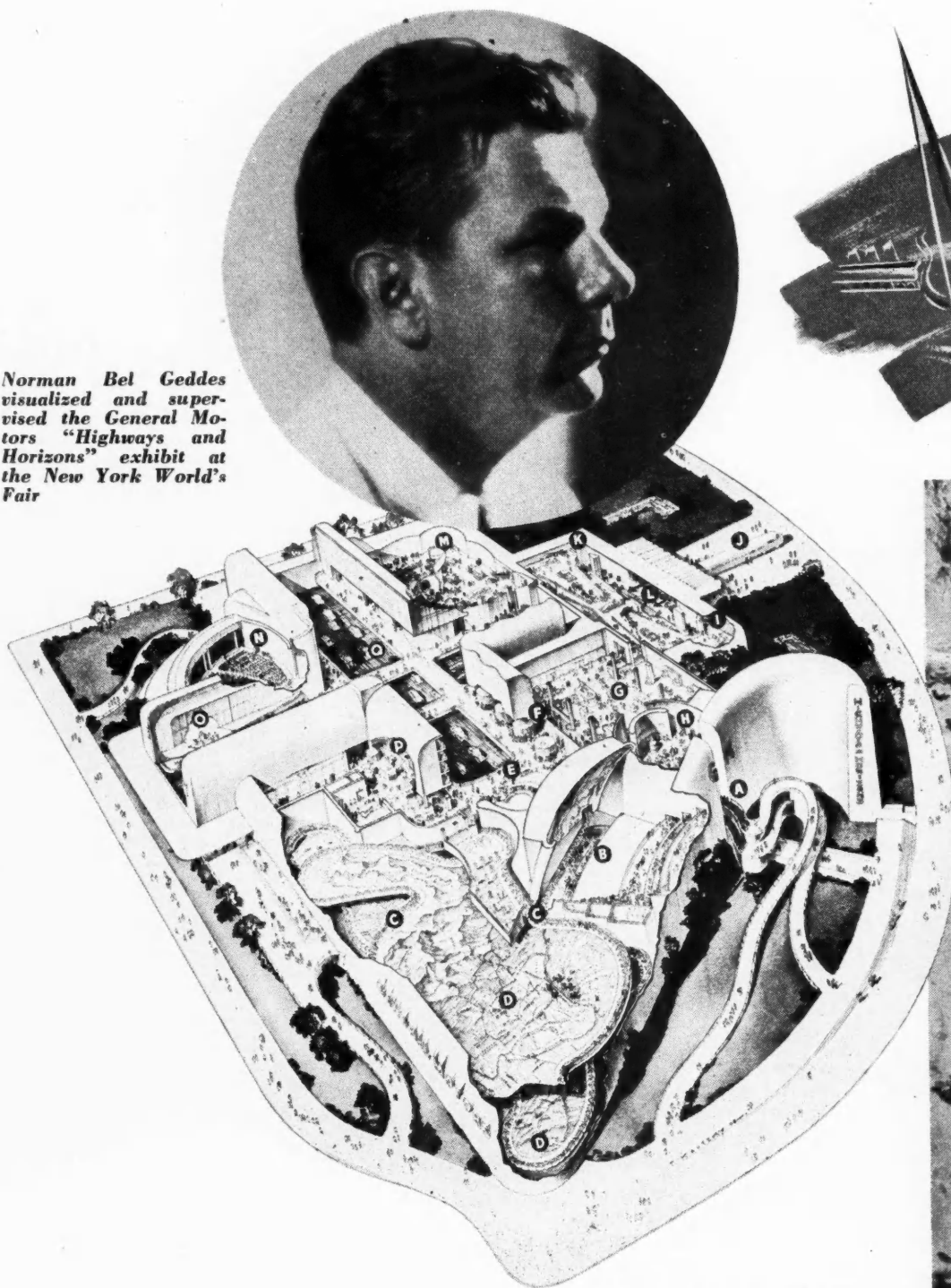
Note particularly the special feeding device at the left, automatic hemmer, and the magazine stacking unit at the extreme right.

As illustrated, core assembly stations are located on both sides of a moving conveyor belt which transports the finished cores to a baking oven. Another illustration shows the special patented core cleaning and soldering oven which carries cores on a long endless woven belt through the cleaning stage, air heating chamber, then to the cooling table, and finally to the saw and straightening device.

The line is provided with a number of specially de-

(Turn to page 562, please)

Norman Bel Geddes visualized and supervised the General Motors "Highways and Horizons" exhibit at the New York World's Fair



Perspective of a "Fair Within a Fair," as Made for a Diversified Body

WHEN the tumult and shouting of the New York World's Fair has subsided, millions of Americans are likely to remember the General Motors' "Highways and Horizons" exhibit when other less significant spectacles may be forgotten. In it, there is the indication of a new era opening for the motor car, when it will enter a third phase of development since its inception as a horseless carriage. In the new period, as visualized by Norman Bel Geddes, better highways, traffic control and equipment will be coordinated with better motor cars, synchronized with the highway operating devices. True, the General Motors Corp. makes no such far-reaching claims, but they are nevertheless implicit in the exhibit. The entire exhibit is pre-

Ground plan of the General Motors Exhibit (leftward) shows the main entrance (A), the map lobby (B) where the "sound chair" tour of the exhibit begins, touring sound chairs on the "carry-go-round" (C), animated scale-model "Futurama" (D), unloading platform and elevated pedestrian sidewalks on the full scale future street intersection (E), the "World Horizons" exhibit of General Motors overseas operations (F), the Frigidaire Division display (G), and exhibit of the General Motors Research Laboratories (H), display of the Inland Mfg. Division (I), a 4000 hp. streamlined Diesel locomotive (J), the traffic and safety information center (K), stairways to Diesel engine and Fisher body exhibits (L), the car display salon (M), the Casino of Science, presenting a stage show of science and research (N), General Motors employee headquarters (O), exhibits of the General Motors accessory divisions (P), and the street level of the intersection of the future (Q).

Bel Geddes, General Motors In Fair's Biggest Stunt

City of the Future portrayed in a vast panorama of super-miniatures; modern Gullivers to circle Lilliput in moving chairs wired for sound



This is a visitor's-eye-view of a small portion of the "Futurama" in the General Motors' World Fair Exhibit

that to adhere too closely to the lines of any of the present highway engineering theories would be to sacrifice the main purpose of the entire project, which is to stimulate public interest and imagination. General Motors dedicates its exhibit to improvement in our streets and highways in the firm belief that to increase the avenues of transportation is not only to increase the broad economic service of the automobile industry itself but, more importantly, to enrich the lives of all the people."

Why was Norman Bel Geddes selected to design this vision of the future? A few comments on his life may partly explain both his qualifications and one of his greatest "productions." He was once ejected from school for cartooning the teacher. He learned about sleight-of-hand and magic from that master of the art, the late Keller, and appeared on the stage in his own magic act as a young man. He stud-

sented with the statement that "General Motors does not seek to predict what the roads of the future will be. Rather it seeks to express the conviction that highway progress, directed by experienced and forward-looking highway officials, will be an even more important influence for national progress in the world of tomorrow than it has been heretofore. The best present knowledge and experience in traffic engineering and highway planning was utilized in the creation of 'Highways and Horizons.' However, it was believed

ied at the Chicago Art Institute, until a celebrated Norwegian painter—Hendrik Lund—advised him to go his own way. He did and improved his working knowledge of anatomy with his personal art class—at the city morgue. He worked as a bus boy in a restaurant, a super in the Chicago Opera Co., and had a job at \$3 a week with a Chicago advertising agency. Later, he did portraits of such distinguished persons as Mme. Schumann-Heink, Brand Whitlock, Tita Ruffo, John Wanamaker and others.

A monastery, clinging to the hillside, is one of the scenic wonders of the General Motors "Futurama," designed by Norman Bel Geddes and constructed under the supervision of George Witthold of the George Witthold Studios



Norman Bel Geddes in the background and a workman's legs in the foreground illustrate the true proportions of buildings in the "Futurama"

In 1914, he went to Detroit and was connected with an engraving company. He became art director at a substantial salary. There, he devoted so much time to the theater that the company suggested he quit one job or the other. He quit the art directing and kept the theater. There, his famous stage productions have included the "Miracle" and more recently "Dead End." This mastery of the technique of the theater is evident in the showmanship with which General Motor's "Highways and Horizons" has been presented to the public.

In 1927, Mr. Geddes entered a second phase of his career . . . industrial design. Today, he is not only one of the foremost, but also one of the highest paid, industrial designers in the world. It is this knowledge of industry and products that has contributed to the practical engineering aspects of the General Motors exhibit.

Peculiarly enough, he has not designed many automobiles. Yet, his first industrial commission was from

In this picture Geddes looks over the miniature kingdom he has created for the General Motors "Highways and Horizons" exhibit. Top center is a light, not visible to spectators of the "Futurama"

a friend who had inspired him to enter this branch of design . . . Ray Graham of the Graham-Paige Co. Geddes created a series of motor car bodies in 1928 to progressively lead up to a car of the future, five years in advance. The company got what it wanted, but never manufactured the cars. Actually, the 1932 model as projected could be driven today and attract but little attention on 1939 highways.

With the tempo of social change and acceptance of new ideas accelerated today, the world is beginning to catch up with designers like Norman Bel Geddes. How rapidly the world can overtake the significant and logical developments envisioned in "Highways and Horizons" remains to be seen. Certainly, what millions of Americans see in the great 7½-acre General Motors building at the Fair will have some influence on American thinking about highways, traffic and motor vehi-

cles. In that, General Motors Co. is rendering a broad service to the entire automotive field, from which the profits are intangibles of the future and open to the industry as a whole.

The spectator of General Motors' "Highways and Horizons" enters a great darkened hall to descend a carpeted ramp toward a moving sidewalk, faced with rows of upholstered chairs moving sideways at the same speed as the walk. During the descent of the ramp, an amplified voice describes traffic conditions of today and what they will be in 1960 with present highway design. The talk is illustrated on a great relief map of the United States. Finally, the map shows the proposed super-highways or motorways that would change all that and which imply far-reaching changes mechanically in the motor cars of the future.

reaching these highways from adjacent communities.

These motorways are designed to permit 50 miles per hour at all curves. Auxiliary lanes for entering the motorways permit building up speed to the 50 mile minimum. There are four main traffic lanes, separated by 3-foot high separators, while individual lanes of similar speeds are confined by 18-in. separators. At certain points where breaks are provided, cars may

(Turn to page 586, please)



The "Futurama" covers 35,000 sq. ft. actually, and reproduces to scale hundreds of square miles. It is the largest scale model ever constructed and portrays 500,000 buildings and houses, over a million trees, and 50,000 motor vehicles. Visitors view it all from the "carry-go-round"

Seated in the chair to which the spectator steps from the sidewalk, a concealed voice in the upholstery carries on an intimate conversation describing the countryside seen through an unending band of glass windows. There is rolling farm country, industrial towns, cities, airports. Most important of all, there are the motorways of the proposed future carrying their traffic load in controlled lanes at high speeds with feeder roads

Snowcapped peaks rise to a scale height of 15,000 ft. in the General Motors "Futurama." A miniature express motorway winds upward through the rocks

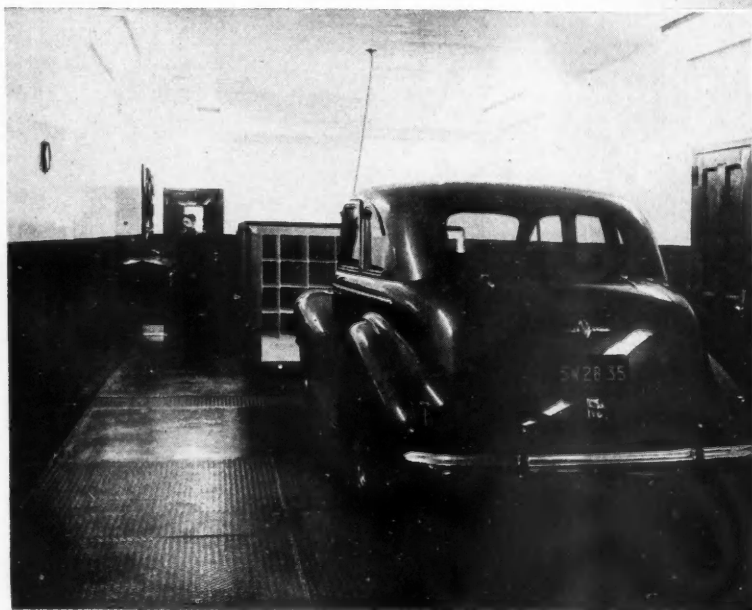
So, They



Artist's perspective of the new Harrison wind tunnel

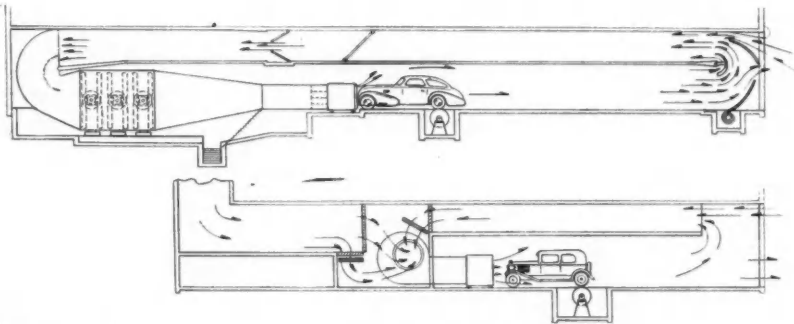
WHEN the automobile industry was still more or less in its infancy, experimental cars were taken out on the road by test crews, and faults in their design or in the materials of their parts were brought to light by hard driving. As the conditions which tax the parts of a car most severely, such as steep grades and high atmospheric temperatures, were not always present in the vicinity of the factories, these experimental cars sometimes were taken to distant points, and the writer remembers model-test expeditions to Colorado, Wyoming, and even to Cuba. Today most experimental development work is done close to the points of production, either outdoors on "Proving Grounds," or indoors in dynamometer laboratories. It is now possible to reproduce practically all of the road-driving conditions which affect the behavior of the powerplant in the laboratory, where observations and measurements can be made more conveniently and more accurately.

Harrison Radiator Division of General Motors Corp., Lockport, N. Y., about ten years ago installed a wind tunnel for the purpose of experimentally determining the radiator requirements of different cars. With the growing power and speed of cars, this tunnel in recent years had become inadequate, and installation of a more modern

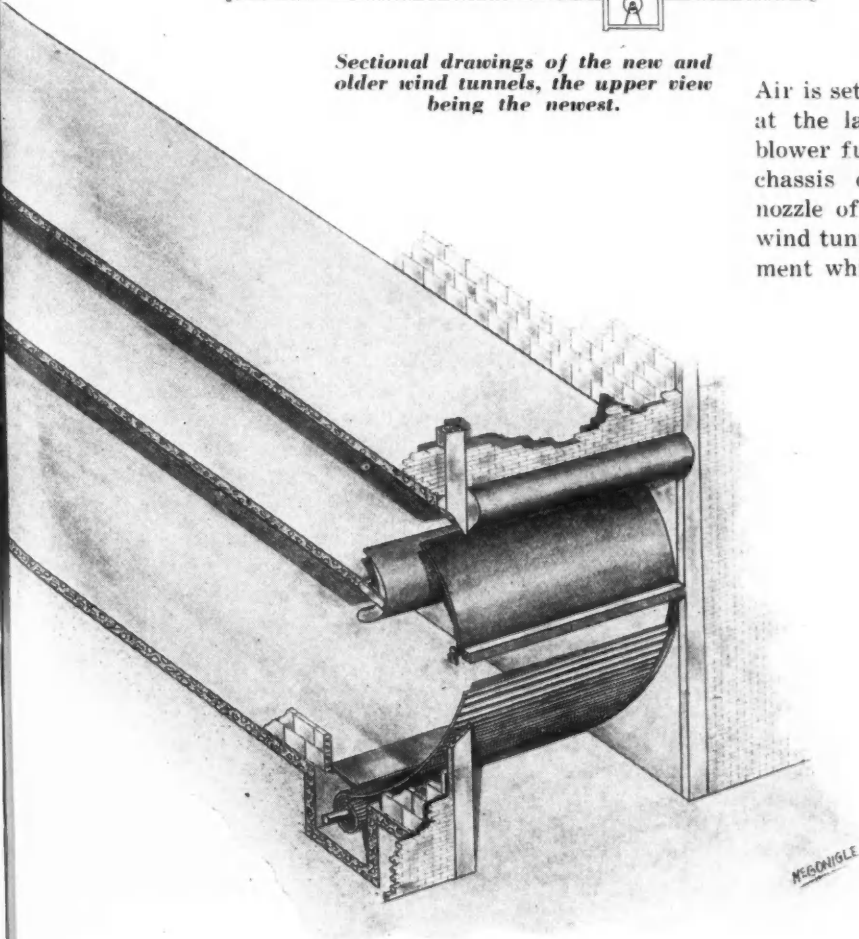


Built a Wind Tunnel—

to fit the growing speed and increased power of new engine designs. Harrison Radiator steps forward with up-to-the-minute research and testing equipment



Sectional drawings of the new and older wind tunnels, the upper view being the newest.



At the left is reproduced a photograph of a car in position for wind tunnel tests. Down the aisle at the left of the view can be seen the control panels

wind tunnel at the Lockport factory has just been completed. A number of illustrations of this installation are shown herewith.

The large drawing shows a perspective view of the new tunnel, as well as vertical sections of both the old and new tunnels (for the sake of comparison). From the sectional view it will be seen that the new tunnel is in the form of a closed circuit composed of two parallel ducts one above the other and communicating at their ends.

Air is set in motion by fans installed in the lower duct at the large end of what may be described as the blower funnel, and a car to be tested is installed on a chassis dynamometer opposite the smaller end or nozzle of the blower funnel. At the near end of the wind tunnel in the drawing there is a shutter arrangement which permits of discharging the air to the atmosphere after it has passed through the tunnel once; of recirculating all of the air, and of recirculating part of the air and discharging the remainder to the atmosphere, taking in an equivalent amount of fresh air.

The air current through the nozzle of the tunnel is produced by six 10-ft. fans, three with ten and three with fifteen blades, which are driven by three 100-hp. electric motors. It is possible to get air velocities at the nozzle ranging from 5 to 110 m.p.h., in steps of 1 m.p.h. or less. The speed of each fan motor can be varied in ten steps, and intermediate adjustments of air velocity are made by means of a damper which introduces additional resistance in the air circuit. The need for close control over the air velocity down to such a low limit as 5 m.p.h. arises from the fact that not only passenger cars, but also motor trucks are tested in this wind tunnel, and some of these trucks have very low gears in their transmission and can be made to absorb their full engine power at an equivalent road speed of 5 m.p.h. Another thing that makes the possibility of air—

(Turn to page 565, please)

Just among Ourselves

IT gives us a lift to realize that the first issue of AUTOMOTIVE INDUSTRIES in its new form coincides with the opening date of the New York World's Fair. So far as we know, Mr. Grover Whalen is not planning any special events to celebrate the coincidence. As for us, we rest happy in the knowledge that even the most hard-boiled observers are predicting that the Fair will be a financial and psychological success. Many of the ten-minute eggs in our own field have expressed the same view about our face-lifting operation. Whatever your Brinell number may be, we'll be glad to have your opinion on the subject.

Hydraulic Brakes Routed "Truckward"

Now that the hydraulic brake has conquered practically the whole of the passenger-car field, both in this country—where it originated—and abroad, people naturally wonder whether it is destined to predominate equally in the commercial-vehicle, and especially in the truck field.

There are two advantages which account for the preference of hydraulic brakes for passenger cars. This type of brake made its appearance at the time when the question of the use of four-wheel brakes first seriously occupied the minds of automobile engineers. One of the difficult problems connected with the application of brakes to all four wheels was that of the transmission of the force of application to the brakes on the front wheels. The hydraulic principle made possible a simple solution, and it was undoubtedly to this fact that the hydraulic brake owed its rapid adoption after the public had become convinced of the advantages of braking on all four wheels.

The other advantage referred to is that of the inherent equalization of the forces of brake application between brakes on opposite sides with hydraulic application, and of the assurance of the division of the force of application between front and rear brakes in accordance with the intentions of the designer.

In the application of hydraulic brakes to large, fast vehicles, some of the difficulties encountered even in their application to passenger cars are greatly intensified. One of the problems connected with the development of hydraulic brakes is that of finding a brake fluid which will operate properly at both the highest and the lowest temperature which may be reached in service by any of the parts containing it. At the lowest atmospheric temperatures, such as are reached occasionally in the Northern states in winter time, it is difficult to keep the liquid sufficiently fluid so it will flow readily through the necessarily small tubes. From this point of view no greater difficulty need be antici-

pated in truck than in passenger-car applications. It is when atmospheric temperatures reach the other extreme that truck service is more severe. It is impossible to provide heavy trucks with brakes having the same frictional area or radiating surface per pound of gross vehicle weight that is provided in passenger cars and, besides, the brake drums must be placed inside the wheels, where they are not exposed to the air current created by the motion of the vehicle, as they are in passenger cars; hence it is quite apparent that in long descents on the brakes the temperatures inside the brake drums must reach much higher values. Now, with hydraulic brakes it is imperative that the brake liquid should not reach its boiling point, for if it did vapor would form in the system, some of the liquid would be forced out, and the brake would become inoperative because of the compressibility of the vapor. Therefore, all parts containing brake fluid must be kept below this temperature, and one suggested solution of the problem is to place the brake cylinders outside the brake drums, where they get the benefit of the draft. This, by the way, would not be a new arrangement, for the original hydraulic brake, which was of the external band type, had the brake cylinder outside the drum.

Charting Your Course Through This Issue

There are many surface changes in this issue of AUTOMOTIVE INDUSTRIES as compared with its immediate predecessors. There are, however, no omissions of the departments to which you have become accustomed, and a good many pages of editorial matter have been added. To summarize: the news department has been moved from the front to the back of the magazine. "Business in Brief," the news article which summarizes the automotive production week in Detroit, and the chart of automotive production activity, have been combined on the third page of the editorial section, where they will be found constantly. Other new material has been added to the same page with the intention of making it a compact summary of automotive and general business. Other departments in the news continue to appear under that heading. Sectioned drawings of engines reappear, to begin Series III of what we have been told is a notable contribution to the industry's textual material.

The Editor has exercised one of his perquisites in taking over the first two pages in the editorial section. This page, then, becomes a general editorial page which will be open to other members of the staff and will be thereby presumably broadened in interest.

—H.H., P.M.H., H.H.

CONTINENTAL FOUR-CYLINDER

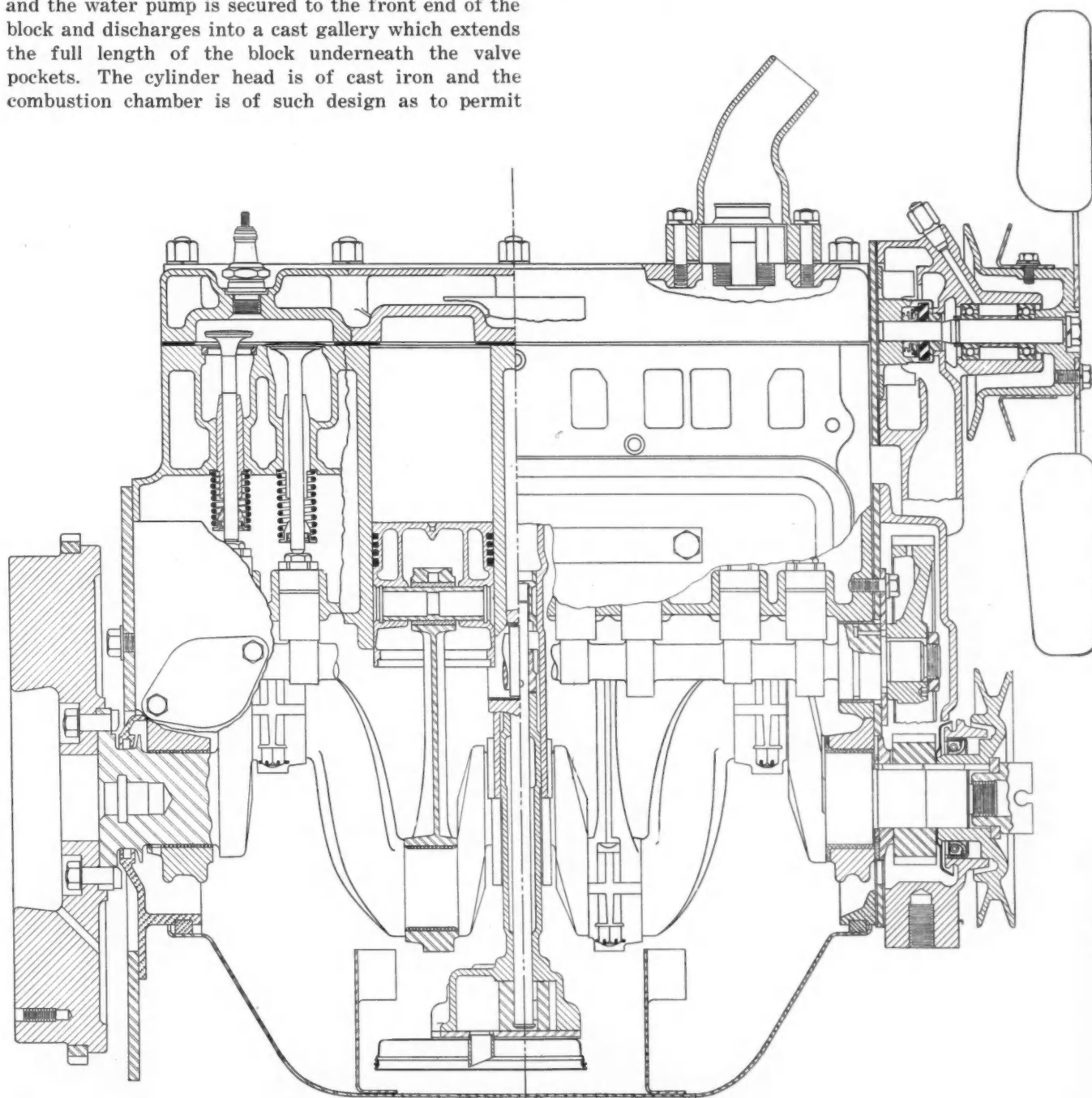
45 HP. ENGINE

Longitudinal Section

THE drawings herewith represent the Continental F-4124 engine, one of a series of three four-cylinder engines for automotive (tractor) applications. This particular engine has a bore of 3 and a stroke of $4\frac{3}{8}$ in. The other two models of the series have bores of $3\frac{3}{16}$ and $3\frac{7}{16}$ in., respectively, while the stroke of all three is the same. The cylinder block is of the individually-ported type. Its water jackets extend the full length of the cylinder barrels, and the water pump is secured to the front end of the block and discharges into a cast gallery which extends the full length of the block underneath the valve pockets. The cylinder head is of cast iron and the combustion chamber is of such design as to permit

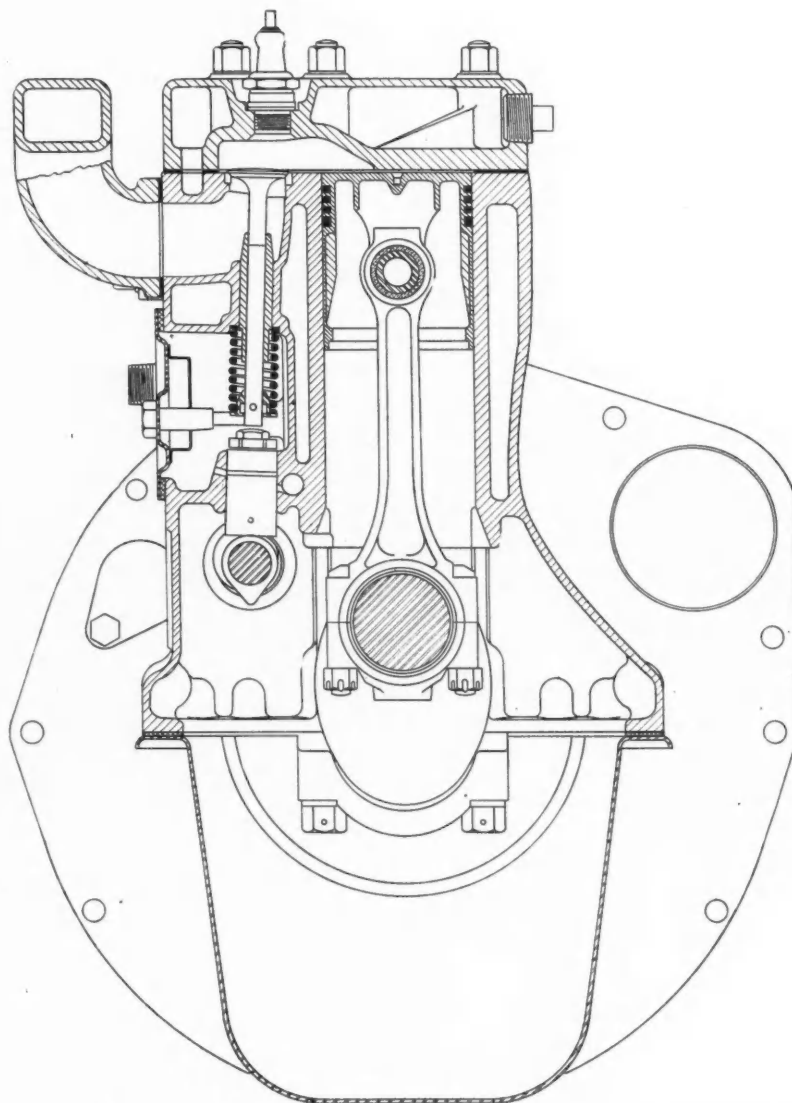
of the use of the relatively high compression ratio of 6 to 1.

Pistons are of cast iron and tin-plated. A cylindrical strut extends between the piston head and the piston bosses, which is claimed to give not only additional rigidity but also more nearly uniform heat flow. Piston pins are of the full-floating type and are retained by snap rings in the bosses. They are lubricated by an indexed spurt hole in the connecting rod head which



Transverse Section

CONTINENTAL FOUR-CYLINDER 45 HP. ENGINE



produces a spray along the thrust side of the cylinder bore and across the top of the piston head. Oil dripping from a cone at the center of the piston head drops directly into a cup at the upper end of the connecting rod. The bearings in the piston bosses are lubricated through oil holes drilled in the bosses.

The crankshaft, which is of the three-bearing type, is of very substantial design, weighing 35 lb. Crankpins are of 1 15/16, and main journals of 2 1/4-in. diameter. All bearings are of thin-shell interchangeable type and have a tin-base babbitt lining. The connecting rod has a center-to-center length of 7 in.

Cams are designed with a quieting ramp on the lifting, and a rapid-closing ramp on the closing side.

The oil pump is driven through a gear cut on the center bearing of the camshaft. Tappets are of the barrel type, of 1-in. diameter, with self-locking adjusting screw. They are lubricated by oil under pressure. All valves are of "XCR" austenitic steel. The water pump is of the ball-bearing type with sealed bearings. The seal is of the Schwitzer-Cummins type, with a carbon thrust block for the sealed surface, which is backed by a neoprene shroud to prevent internal leakage.

A governed speed of 3,000 r.p.m. is recommended, at which the output of this 123.7-cu. in. engine is slightly more than 45 hp. The net weight of the engine is approximately 356 lb.

Economy and Varied Requirements

(Continued from page 545)

Factory Routing Mainshaft Gear and Bushing Assembly

OPERATION	EQUIPMENT
Press in bushing	Bench
Peen bushing	Bench
Burnish broach	Fox power press
Drill oil holes	Henry and Wright drill press
Face bushing to length both ends	Bryant grinder
Bore hole	Heald Bore-Matic
Lap	Gleason lapping machine
Polish outside hub	Blount lathe
Polish inside hub	Blount lathe
Wash	Crescent washer

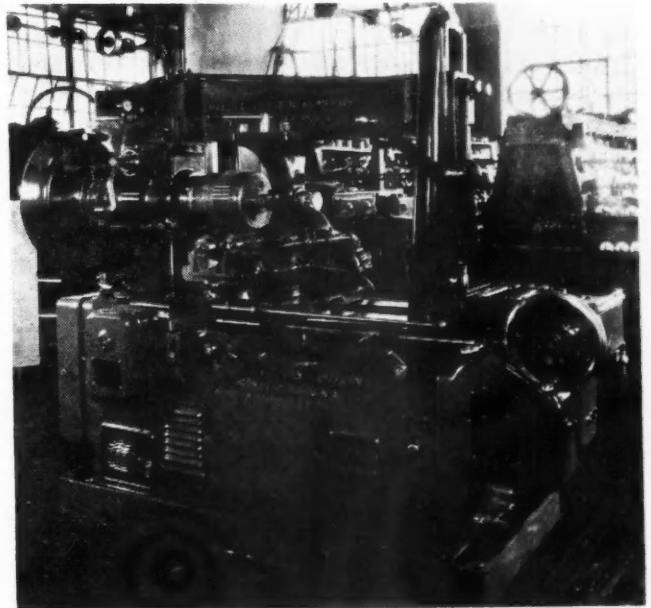
ness which equals or exceeds that obtained in the small passenger car transmissions.

Since the very nature of the production process is that of multiple-lot production, the keynote of every step in the machine shop is flexibility. Consequently, the visitor will find that most of the production machinery is of universal type, capable of quick change-over from one job to another. How acute the situation is, may be gaged from the fact that entire departmental set-ups may be completely changed as often as four to five times a week. However, skilled production management has met the challenge by providing suitable fixtures and tooling which offer the maximum of interchangeability on machine beds or tables, contributing to ease of changeover.

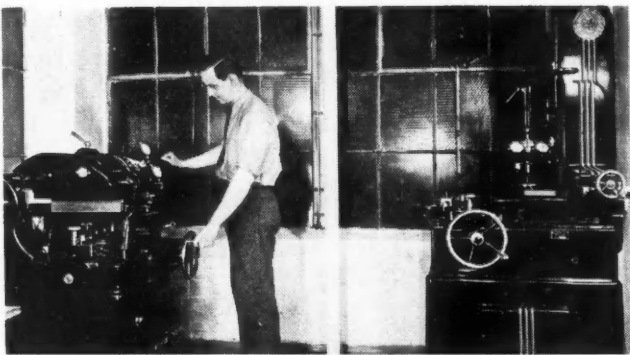
Perhaps the best contribution in the field of quality gear manufacture has been made by this organization in the course of modernizing the gear department. Not only does it exemplify the last word in certain items of

equipment suitable for multiple-lot work, but it emphasizes a unique approach to the production of a large variety of gears with a definitely limited tooling. It is a case of designing gears to fit the tools rather than reliance on conventional gear practice with its multiplicity of tooling.

Actually the gear problem involves some 1400 gear designs, of which no less than 300 may be considered active. Despite this great variety, all of the 300 and many of the remaining gears can be produced with but 15 shaving cutters. This total includes 4 cutters for herringbone gears, and 2 special spur cutters for close shoulder work.



New, Type A, Barber-Colman hobbing machines used for primary gear cutting operations in this department. Several of the latest units are fitted for climb-cutting, as described in the text.



Important phase of the operation of the new gear department is this gear "lab" with facilities for checking gears, gear cutters, new machine set-ups, etc. At the right is the new Michigan universal lead checking machine, one of the very first machines of its type in use in the industry.

Many of the production gears really cannot be termed standard, since design elements are changed appreciably to suit manufacturing conditions. For example, if given a 12/45 ratio combination, within limited centers, the 12-tooth gear, the weaker of the two, would be strengthened by oversizing both tooth thickness and diameter; the larger gear would be designed correspondingly smaller in its elements.

Occasionally the customer's requirements cannot be met by the ratios available in a standard gear box. In such cases, it is frequently possible to generate say 20 teeth in a standard 21-tooth blank; or 46 teeth in a 45-tooth blank. Needless to say, this unorthodox practice hinges upon a special conception of gear design. As we understand it, their first step in design-

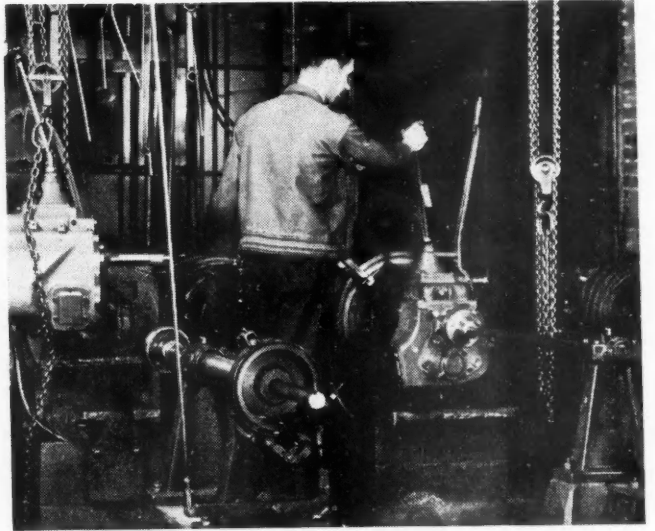
ing a special gear train is to determine by calculation that there is continuity of action between the mating gears. Also by calculation they make certain that the crossed-axes shaving cutter will not hit the fillet left by the roughing tool at the root of the tooth, yet will cut deeply enough to shave beyond the maximum entering depth of the mating gear.

If the geometry of mating gears does not satisfy the conditions outlined above, the design is suitably altered before releasing for production so as to make possible the use of available cutters.

As a further check on production releases, the engineering department makes a special computation of gear tooth size, as measured across pins, to be sure that the fillets located geometrically, by calculation, will come at precisely that location in production. It is a rigid rule that no changes in size may be made without permission from the engineering department. All hobs, shaper and shaving cutters are identified by special numbers assigned by the engineering department.

Best picture of the type of equipment in this plant can be gained by a study of the several factory routings reproduced here. So far as the gears are concerned, it is of interest to note that all gear blanks are drop-forged and case carburized. Gear tooth forms are semi-finished either by hobbing on Barber-Colman machines or shaping on Fellows high-speed gear shapers, depending upon the size and form of the gear blank.

Gear blanks, in the green, are shaved to finish size and form on a battery of three new Michigan gear shavers, using crossed-axes rotary cutters. After heat treatment, the gears are lapped in sets on a battery of special Gleason gear lapping machines modified as



"Customer" inspection to assure gear quietness. As the transmissions come off the assembly line they are routed directly to the quiet room, shown here, where they are subjected to rigid inspection for quietness and operating characteristics.

to fixtures, cycle, and lapping compound application, according to extensive study by Fuller gear experts.

Gear production provides some interesting examples of interchangeability of tooling and work-holding fixtures. Take, for example, the set-up for internal grinding, or precision boring on the new Heald Borematic. In every instance, the machine is equipped with a standard chuck capable of handling the entire variety of work for which it is intended. Work is chucked on the outside diameter invariably, so as to assure precise alignment of the pitch circle with the bore. For this purpose, each chuck is provided with a number of sets of interchangeable jaws, each set capable of accommodating a given range of diameters, each set being quickly adjustable in the chuck body.

As will be noted, there is an external grinder alongside each shaving machine, the outside diameter of gears being accurately ground while they are still mounted on the shaving arbor. This makes both outside diameter and pitch circle concentric. The gears are then chucked by the outside diameter for all subsequent hole grinding or boring operations.

Of outstanding importance in machine shop practice is the adoption of climb-cutting for hobbing operations. Four new Barber-Colman, Type A hobbing machines, first units in the new program, are designed for climb-cutting, exclusively, and feature the rugged construction and extra heavy thrust bearings required for this principle. Fuller engineers claim that climb-cutting has yielded about 35 per cent improvement in cutter life, faster cutting speeds, greatly improved finish. Production examples of this kind will constitute an invaluable basis for the future advancement of machine shop practice.

The machine shop set-up is quite conventional, so far as equipment goes, although the actual practice is based on the considerations of flexibility and interchangeability of tooling as noted earlier. Familiar items of machinery are found at every turn—Lo-Swing lathes, Potter & Johnston heavy-duty turret lathes,

Factory Routing Mainshaft Fourth Speed Gear

OPERATION	EQUIPMENT
Drill	Baker drill press
Broach	Oilgear horizontal broach
Rough and finish turn	Fay automatic lathe
Cut relief and break corners	Foster lathe
Ream relief burr	Aurora drill press
Cut internal teeth	Fellows high speed shaper
Rough cut teeth	Barber Colman hobber
Finish cut teeth	Fellows high speed shaper
Wash	Niven washer
Chamfer internal teeth and recess every other tooth	Peerless gear chamfering machine
File burrs and wire brush	Bench
Shave and green grind outside diameter	Michigan tool shaver and Norton grinder
Face file after shaving	Bench
Wire brush outside diameter after shave	Bench
Mill 4 notches and file burrs from notches	No. 6 Whitney hand miller
Drill oil holes between teeth	Atlas drill press
Remove burrs from oil holes	Bench
Wash	Niven washer
Harden	Carburize
Grind burr from hub of gear	Bryant grinder
Grind hole and face off counterbore	Bryant grinder
Grind ends of hub	Bryant grinder
Break corners	Blount lathe
Polish edges	Blount lathe
Wash	Crescent washer

Cincinnati and Ingersoll milling machines for the cases, Natco drill presses, Hammond radial drills, Oil-gear horizontal hole broaching machines, and a variety of similar equipment.

Particular attention has been paid to the tooling of these machines. For example, the large milling cutters used for milling cast iron parts are tipped with Stellite J-metal. Tools for turning cast iron are invariably tipped with Carboloy. It will be noted that this practice is rather advanced for multiple-lot production.

The pictorial section gives a good perspective of an unusual final assembly line bending around the parts stores department which serves it with component parts. The terminal of the assembly line leads directly to the quiet room.

Quality control is made a vital part of every detail of manufacture to assure long life and the desired quietness. Parts of every description are closely controlled in process to assure conformity to established dimensions and clearances. Then, as noted before, the gears are lapped in pairs to assure quiet mating trains. Finally, the assembled transmissions are routed to the final quiet room test where they must pass muster on the basis of customer acceptance.

Control of the basic gear cutting operations is centered in the gear laboratory which checks all gear cutting tools, checks the set-up on each machine by a rigid inspection of sample gears. Prize exhibit in this laboratory is the first universal involute checking machine of its type developed by Michigan Tool. This machine has the advantage not only of precise measurement but of rapid set-up for checking any gear. Feature contributing to rapid inspection is the use of a single basic pitch circle, requiring only a re-setting of a single sine bar according to a standard formula.

Business in Brief

(Continued from page 541)

aged 367,000 tons daily, as against 310,000 tons in the preceding week and 910,000 tons in the like period last year.

The output of electricity by the light and power industry in the same week declined against the seasonal trend; but the margin above last year's corresponding production was raised to 10.9 per cent, as compared with 9.2 per cent in the preceding week.

Production of crude oil in the week ended April 15 averaged 3,494,500 barrels daily, as against 3,443,900 barrels in the preceding week and 3,385,400 barrels a year ago. Daily production requirements this month, as computed by the Bureau of Mines, are 3,434,000 barrels.

Engineering construction awards during the week ended April 20 registered a fifth successive increase over corresponding 1938 levels. For the first 16 weeks of the year contracts totaled \$993,540,000, or 22 per cent more than in the like period last year, according to *Engineering News-Record*.

Business failures during the week ended April 13, as reported by Dun & Bradstreet, numbered 265, as compared with 245 in the preceding week and 297 a year ago.

Professor Fisher's index of wholesale commodity

prices advanced again last week, standing at 80.3, as against 79.8 for the preceding week and 79.6 for the first week of the month.

Reserves of member banks of the Federal Reserve system increased \$215,035,000 during the week ended April 19. Estimated excess reserves rose \$120,000,000 to a new peak of \$4,000,000,000.

Photo-Elastic Methods of Stress Analysis

A FURTHER development in photo-elastic methods of stress analysis is reported from Columbus, Ohio. A transparent model of the part whose stress distribution is to be studied is made of bakelite or other suitable material, and the model is placed under stress equivalent to that to which it is subjected in regular use. It is then immersed in an oil having the same optical properties as the material of the model itself—to prevent deflection or bending of the "slicing" beam on entering and leaving the model. By focusing a "slicing" beam on any part of the model, the latter may be "sliced" in any direction, and the stress distribution in the "slice" may either be studied directly by the eye, or it may be photographed for a permanent record. Scattering of the light by the model at right angles to the original beam produces a visible pattern which is indicative of the stresses occurring in the part under actual working conditions. When the load is removed the model remains intact for any future use.

This new method of photo-elastic analysis is due to Royal Weller, instructor in physics and a member of the experiment-station staff at Ohio State University. He will give a detailed report on the new method at the Eastern Photo-elastic Conference which is to be held at Cornell University, Ithaca, N. Y., on May 13.

Heretofore, in making stress-distribution studies, investigators stressed their models at about 230 deg. Fahr. and then allowed them to cool under load to preserve the distortions. Then they actually cut out a slice of the model and examined it for stress patterns. With Mr. Weller's method no actual slicing of the model is required, and the light beam may be used to "slice" the model in as many directions as may be desired. No distortion of the pattern can result from cutting operations, and the model is not destroyed by the test.

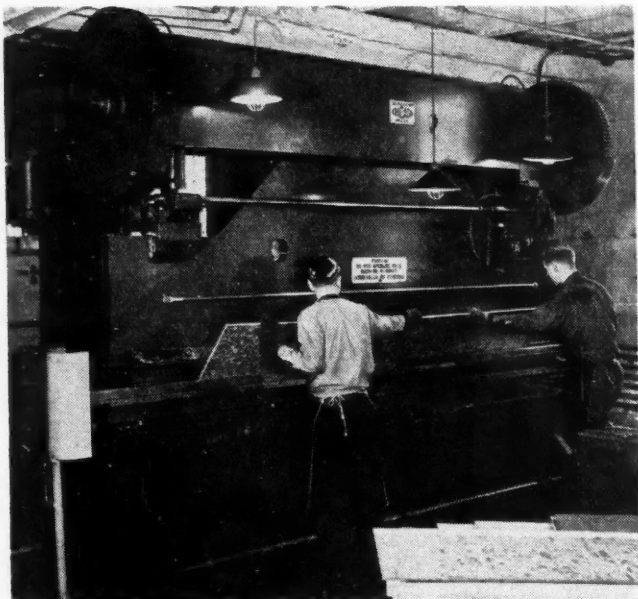
Future of Electric Vehicles

IN a discussion on the subject of "Electric Battery Vehicles and Their Future Possibilities," before the Institution of Electric Engineers in London, G. O. McLean said that 1918 was a suitable date from which to trace the development of electric trucks in Great Britain. That year there were approximately 100 such vehicles in the country, while in 1938 the number had risen to 4000. About 1919 a number of unsatisfactory electric trucks were placed on the British market, which gave the entire development a severe setback. He said the design of electric trucks had improved constantly—the same as that of other types of commercial vehicles—especially as regards loading levels and accessibility of the batteries.

Versatility Marks Young's Production

(Continued from page 549)

signed rotary or merry-go-round machines to facilitate certain operations. One of these is a rotary soldering machine for fusion bonding top and bottom tanks to the core header. A similar soldering machine, with power-



Large press brake made by the Chicago Press Brake Co., having a capacity of 12 ft. sheet up to 1/4 in. in thickness. It is used primarily for forming radiator sides for large industrial units

operated table, is used for fusion bonding headers to core tubes. Still another of the rotary machines is a mechanically operated turntable for locating and holding in place the fusion bonding and supply and return pipes. Special torches required for the operation are suspended out of the way overhead. The testing and cleaning tanks for this unit may be seen in the background at the left.

An ingenious mechanized set-up has been developed for the testing of tanks and fittings. A conveyor chain takes the assemblies through the cleaner, overhead to the heating chamber, thence to the paint spray booth, and a return trip through the drying oven.

Quality control, of course, is a basic part of the manufacture of every unit built in the plant. It starts with the initial experimental testing in the research department; it continues through every detail of the process to the final testing of the complete assembly before shipping.

Handling so large a variety of heat transfer units presents a major problem of storing raw materials and component parts for the final assemblies. Two storage departments hold much of interest to the

visitor and customer as well. One of these is a large bay consisting of strong spacious racks on which are stored the various types and sizes of sheet metal, ferrous and non-ferrous. Each shelf is open for quick inspection and each bundle of metal is completely identified for quick reference.

Another department is devoted to the storage of fittings and small parts of every description, the total running into the hundreds of individual items. These parts are pigeonholed in modern bin racks, affording quick access and ready identification when filling assembly orders.

It seems evident to us that the key to the successful record of this organization will be found in the comprehensive research laboratory with its advanced equipment and instrumentation. These facilities make it possible to study heat transfer units of every conceivable type, to design the elements of complete cooling systems, compare the performance of different types of cores, to carry on fundamental research on new projects. We make a particular point of this on the ground that such facilities are as important in this kind of business as are its production machines.

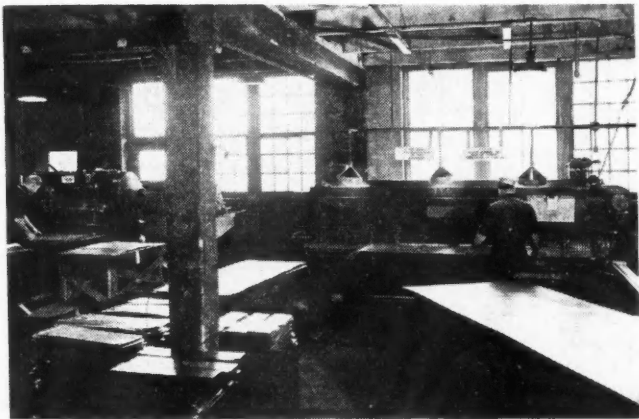
Two wind tunnels provide the center of interest in the research laboratory. The first is a small unit designed to measure the characteristics of foot-square cores (12 in. x 12 in.). Instrumentation is provided for checking air velocity delivered by a high velocity



The company is proud of its raw materials storage facilities, one alley of which is shown here. Feature of the arrangement is the use of heavy I-beams nested on timbers, forming shelves for all manner of strip and coil stock. Each item is clearly identified and readily accessible

centrifugal fan, pressure drop through the core, temperature readings, rate of cooling water flow, etc.

The second unit is much larger and can be made to accommodate full-sized cores within reasonable



Corner of the large shearing room showing a new 10-foot Cincinnati shear with hydraulic hold-downs, having a capacity up to 3/16 in. thickness of stock. At the extreme left is a small shear made by the Chicago Press Brake Co., having a capacity of 48 in. stock up to 14 gage, operated by remote control

limits on the maximum size.

Other equipment includes a device for measuring precisely the actual water capacity of a core; physical break-down machines; and a special set-up for testing full-sized cores under temperature conditions specified by the user according to field operation requirements. The equipment consists of a high pressure booster gas heater which delivers heated water to an overhead mounted storage tank. A variable control of temperature is provided so that the temperature of the water circulated to the core may be maintained under stated conditions.

As a matter of interest we give below an outline of some of the major steps in the manufacture of a typical heavy-duty radiator assembly. Largest unit of the radiator core assembly, and in this particular design, the core includes a large number of copper fins which are punched automatically and cut to proper length. These fins are equally spaced in a jig and tubes previously coated with solder are pushed through them. The next operation is that of bonding the tubes to the fins, being accomplished by immersing the entire core in flux and then heating in a bake oven until the solder coating is thoroughly melted. The core then is withdrawn, placed in squaring fixture and rapidly chilled, thus making a positive bond. Core headers are of heavier gage material than the fins, but are punched in similar fashion and assembled to the ends of the core. It is essential to have a 100 per cent bond between headers and tubes because the slightest space at these joints would cause leakage. This is accomplished by placing the headers on the ends of the tubes and then flaring the latter. Tube ends are immersed in flux and dipped into solder, capillary action providing the bond desired.

Save for shape and minor details the tanks for a sheet metal radiator produced in quantities warrant-

ing press dies, are made in routine fashion. The operations comprise—blanking, forming, addition of reinforcing beads, punching of holes. Individual press operations include punching and flanging for crank tube holes, inlet hole, and outlet hole.

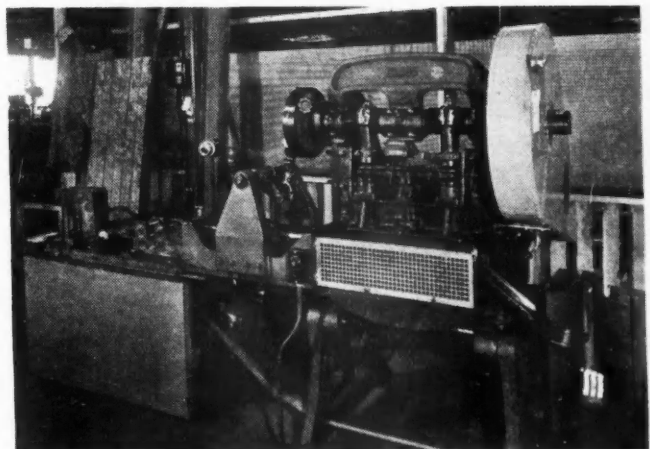
The inlet casting is made of malleable iron and has the rivet holes punched in the die. The outlet casting being of more complicated shape has the rivet holes drilled on a double spindle drill press.

Castings are cleaned and inspected, then riveted to the tanks. Sheet brass reinforcements, properly shaped and punched, are attached to the inner surface of the tanks opposite the castings to provide a triple reinforcement. Solder is sweated at all openings and joints to assure leakproof construction.

The filler neck is a die fabricated part. It is attached to the radiator by setting in a groove in the tank and bonding by torch soldering. Location of retainers in this neck is achieved by lining up a die-impressed mark on the neck with one in the tank. Of vital importance is an anti-siphon baffle located under the filler neck. It is a box type arrangement made of several parts riveted together and, in turn, riveted to the tank. The rivets holding the baffle to the tank are torch soldered to assure leakproof and rattle proof construction.

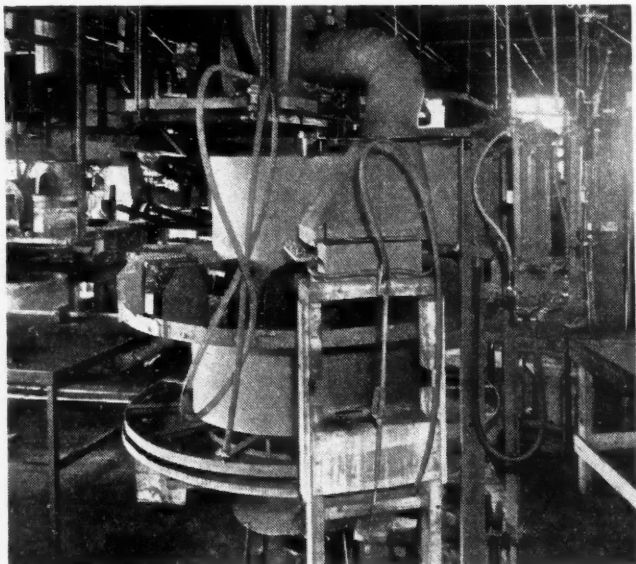
For the best economy the fan shroud is made up partially by hand and partially by die. Two blanks are sheared and holes and brake marks impressed on them by scribing from a properly developed pattern. The scribed blanks then are rotary-sheared to shape and the holes punched. The approximate final shape of the shroud is obtained by hand forming in a brake press. Final shape including the recess is obtained by inserting the partially fabricated blanks in a die and final forming of them. The two blanks then are spot-welded together.

The mounting sides are square sheared to blank size. The desired shape is produced by machine notching according to pattern specifications. The holes for the front screen are pierced at one time by the use of "strippit" dies. The remaining holes are pierced by



Close-up of high production set up for making car heater fins; somewhat similar equipment is provided for general fin manufacture. Here is a Bliss press fitted with a special progressive hemming die, unique unrolling device, automatic feeding device at the left, stacking magazine at the right

a special die. Sides are formed in three separate operations, the long front edge and the top curve being developed by special dies, while the bottom



Typical of the special equipment developed for car heater manufacture is the rotary machine for automatically soldering tanks to the cores

bend is produced in a standard press brake.

The process of final assembly consists chiefly of soldering under controlled conditions. Tanks are assembled to the core and headers—placed in a jig for proper alignment and location, hammered wherever necessary, then sweat-soldered thoroughly along the entire joint between tank and header. A subsequent operation in another jig is required for the final soldering which includes assembling and joining the sides and fan hood to the core and tanks. The two operations are similar except that the function of the latter

is one of strength rather than freedom from leaks.

Several minor soldering operations are required to complete the job. A crank tube is inserted in the flanged crank holes of the bottom tank and soldered in place. A reinforcement plate also is soldered to the front of the tank at the crank tube to provide strength in case of crank slippage.

After final soldering operations, the radiator is tested with compressed air and checked for leaks. Minor leaks are soldered and repaired for final O.K. A fin straightening operation follows during which slightly bent fins are straightened and loose solder is scraped off or shaken out.

The radiator is dried, then prime-coated and packed in a special wire-bound crate for shipment.



Busy item of equipment is this Moline Hole-Hog, multiple-spindle driller, used for drilling a variety of holes in manifold castings

Cooling Fuel Nozzles

CONDITIONS of combustion in Diesel engines are often disturbed by the formation of carbon deposits on the tips of the spray nozzles. Even quite small deposits may completely upset the distribution of the spray, with detrimental results on the operation of the engine. Formation of carbon deposits can be prevented, or at least greatly retarded, by proper cooling of the nozzles, and such cooling has been recommended by a number of engine manufacturers.

The subject of injector cooling was referred to in a paper read before the Diesel Engine Users Association in London by J. J. Broeze and J. O. Hinze of the Royal Dutch Shell Petroleum laboratories. They said they had found it possible to make a cooled injector that is interchangeable with the conventional type. This development work was carried out in collaboration with a maker of injectors, and every step in the development was proved out in practice in the authors'

laboratory. Fuel is used for cooling, which obviates corrosion of the delicate parts. The rate at which fuel is circulated varies between 5 and 10 times the rate of fuel consumption under full load. In order to avoid carbon formation at the edges, the tip of the injector should project about $\frac{1}{8}$ in. into the combustion chamber, which would not be permissible with an uncooled injector. The total amount of heat to be abstracted is small, so it is not necessary to have a special cooler, the only equipment necessary being a 10-gal. circulating tank, a filter, and a suitable gear pump. Some might object to the additional plumbing required, but the authors felt even these would prefer dismantling the somewhat more complicated cooled injectors twice a year to dismantling the simple, uncooled ones twice a month, which, they said, represented the approximate difference between proper and improper cooling conditions.

So, They Built a Wind Tunnel

(Continued from page 555)

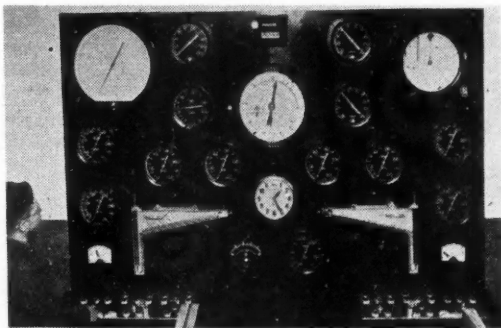
velocity control in the lower speed range important is the fact that side winds and tail winds play a role in road driving, so that high road speeds are sometimes combined with low relative air speeds, and in the low-speed range, say up to 30 m.p.h., a comparatively small change in air velocity has a considerable influence on the cooling capacity.

The air entering the tunnel can be heated by means of heating coils supplied with steam at high pressure. Temperatures in the air tunnel can be read on thermometers with circular dials located on the instrument board on the wall of the wind tunnel, and admission of steam to the heating coils can be controlled from there. The heating coils have sufficient capacity to raise the temperature of the air at the nozzle to 125 deg. Fahr.

The chassis dynamometer installed is the largest size manufactured by General Electric Co. and permits of absorbing the full power output of passenger-car engines at from 5 to 100 m.p.h. In the case of trucks, if there are very low gears in the transmission, not all of the engine power can be absorbed at low road speeds, but the resulting problem was anticipated and the dynamometer pit is so arranged that a water brake or hydraulic dynamometer can be added at the end of the roll shaft to take care of additional power beyond the capacity of the electric dynamometer at low speeds.

The wind tunnel is so designed as to make it possible to get the full air velocity with either recirculated air, all fresh air, or a mixture of fresh and recirculated air. In winter, when it is desired to have the temperature at the nozzle from 75 to 100 degrees higher than the outside temperature, it is advantageous to recirculate the air, as that saves heat, which means fuel. In summer time, on the other hand, when the outside temperature may exceed 80 degs., it is necessary to take all fresh air into the wind tunnel, for even though no heat is added by the steam coils, if the air were recirculated the heat absorbed by it from the fans and in passing through the car would soon raise its temperature to such a point as to make engine operation impossible. By taking only fresh air into the tunnel, all of the heat absorbed is immediately discharged to the atmosphere, and the temperature of the blast from the nozzle remains close to atmospheric.

In the walls of the tunnel adjacent to the chassis dynamometer there are a number of compartments which contain equipment for heat-rejection and other important tests. In heat-rejection tests water can be circulated through the engine jackets without passing



Instrument board and control panel.

through the radiator, and this water is then cooled by an outside supply of water, which flows at a much slower rate than the engine-cooling water, so that its rate of flow and its temperature rise can be readily measured. These two values give the rate of heat rejection of the engine, which is one of the most important factors in establishing cooling requirements. With this equipment it is possible to determine variations in produc-

tion automobiles as well as to obtain the data for the cooling-equipment requirements of any given experimental car.

One of the illustrations shows the instrument board and control panels. Mounted on the board are the following instruments:

Top row, left to right: Dial gage indicating dynamometer load, pressure gage showing steam pressure at heating units, revolution counter of dynamometer, pressure-and-vacuum gage for connection to manifolds, etc., and a recording pressure-and-vacuum gage.

Second row (three instruments): Temperature gage, temperature gage and recorder, pressure-and-vacuum gage for engine and manifolds.

Third row: Six temperature gages for measuring the temperatures at the inlet to and outlet from the engine compartment.

Fourth row: Temperature gage, Ellison draft gage for air velocities, electric clock, Ellison draft gage for air velocities, temperature gage for inlet manifold.

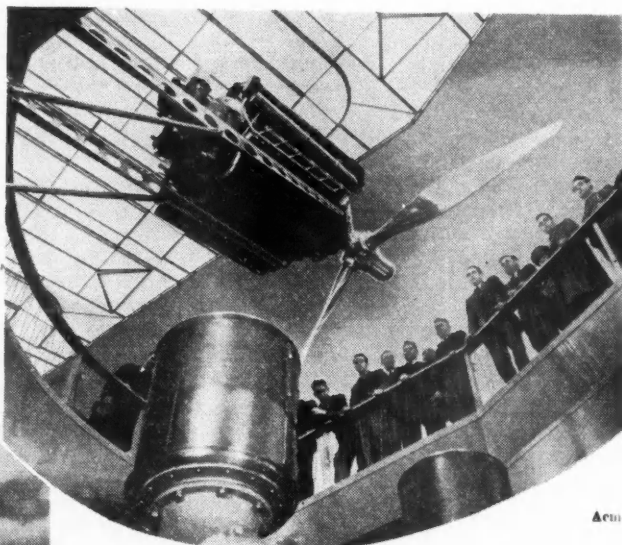
Fifth row: Ammeter showing dynamometer output (under left-hand Ellison draft gage), vernier valve for two steam coils and pistol-grip switches for reversing the dynamometer field connections and controlling the dynamometer load, tachometer for dynamometer, temperature gage for the air under the hood (under right-hand Ellison gage), pistol-grip switches for controlling the revolution counter of the dynamometer and for line control of the dynamometer and a selector switch for making readings of the average temperature across the grid or at selected points of the grid; voltmeter for measuring the dynamometer voltage.

On the tables in front of the instrument board are located push buttons for the control of the nozzle extensions, damper, inlet door, outlet door, car-exhaust fan, motor-ventilating fan, and the three fan motors.

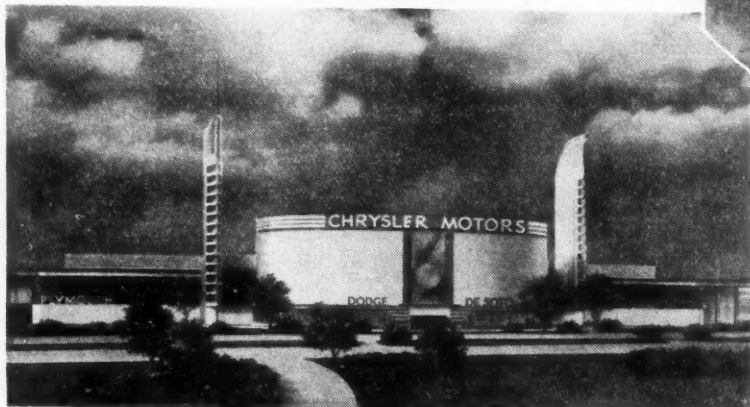
Aside from its use in "fitting" radiators and other items of the cooling system to experimental cars, the wind tunnel has proven useful in connection with development work on carburetors, manifolds, exhaust systems, grilles, car ventilators, fuel pumps, and tires, and in overcoming difficulties due to excessive underhood temperatures and vapor lock.

Land—Air—Water At the World's Fair

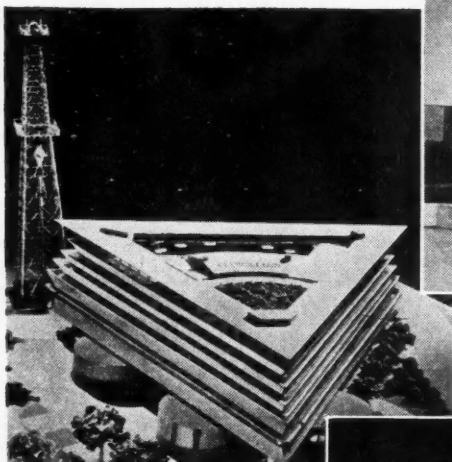
(Right) The new Allison 24-cylinder, 2000-hp. Diesel V-type aircraft engine is shown being viewed by newspapermen and other guests at a preview showing at the New York World's Fair, April 18. Below the suspended aircraft powerplant can be seen part of a Diesel engine for a locomotive. The engine is on display at the GM exhibit.



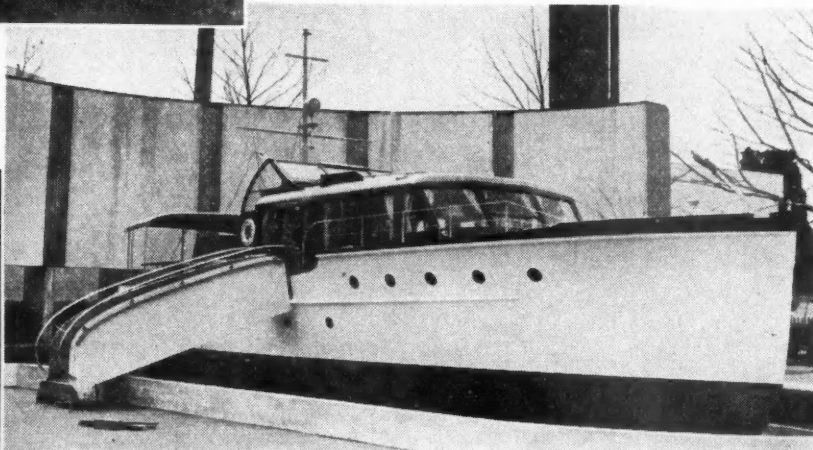
Aerie



(Left) The Chrysler Motors Exhibit Building. Note the Polaroid Mural that rises 38 ft. above the central doors. Designed by Henry Billings, the mural is to be illuminated from behind with white light that takes on constantly changing color to give the illusion of motion.



(Above) Petroleum's world of tomorrow will be this triangle of gleaming blue metal supported 20 ft. above the ground by four huge replicas of oil tanks. A unique feature is the derrick in the background, manned by living workers, which will be used to demonstrate the process of drilling for oil.



Underwood and Underwood

(Above) Boating enthusiasts will find much to interest them at the Fair, such as this effective display of an Elco cruiser.

(Right) Blue and white lighting enhance the night aspect of the Ford Exposition Building.



NEWS OF THE INDUSTRY

Powel Crosley, Jr., Shows New Car at Indianapolis

Long Rumored Event Took Place April 28; Newcomer Lists at \$325 f.o.b. Richmond, Indiana

Powel Crosley, Jr., who built several experimental automobiles 30 years ago and made a success in the automotive accessory business before becoming one of the country's leading radio and refrigerator manufacturers, is back in the automotive industry with a 925-lb. passenger car bearing his name. The car is to be furnished as a two-passenger convertible coupe and a four-passenger convertible sedan, both bodies being well streamlined. It lists at \$325, plus Federal and State taxes, f.o.b. Richmond, Ind.

The Crosley, officially introduced last April 28 at the Indianapolis Speedway, is equipped with a two-cylinder, horizontal-opposed, four-cycle, air-cooled engine produced by Waukesha. A suction blower cast integral with the fly-

wheel is used to cool the cylinders. With a bore of 3 in. and a stroke of 2 3/4 in. the engine has a displacement of 38.87 cu. in. The lubrication system is of the full-pressure type. The Tillotson downdraft carburetor was specially designed for this engine.

Other units besides the engine include a Rockford single-plate clutch, a Warner three-speed-and-reverse transmission, and a Spicer rear axle. The wheels were specially designed for this car by the Motor Wheel Co. A four-wheel braking system is provided, the brakes being of the Hawley type in which the linings are free between the shoes and the drum and can be removed by simply removing the wheel and slipping a length of lining into the brake drum. The braking area is arranged to

Crosley Car Preview

The preview showing and christening of Powell Crosley's new Crosley automobile at the Indianapolis Motor Speedway was described in a broadcast over the NBC-Blue Network on Friday, April 28, at 12:00 Noon, EST.

The car was christened by Crosley's youthful grandson, Lewis Crosley, who broke a bottle containing samples of all standard brands of gasoline over the radiator cap.

Following the christening, three nationally-known race drivers, Lou Meyer, Kelly Petillo and Wilbur Shaw, gave the new car test runs around the Speedway track.

extend over 350 deg. of the brake drums.

The final drive is by a propeller shaft without universal joints, extending through a torque tube. Drive without the use of universal joints is made possible by the method of mounting the powerplant on rubber. Suspension is

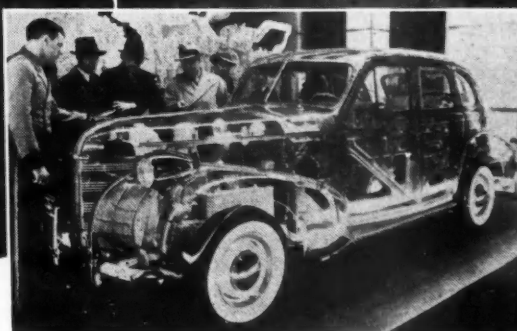
(Turn to page 582, please)

General Motors Dedicates "Highways and Horizons"

(Upper right) Thomas H. MacDonald of the U. S. Bureau of Public Roads is shown with three executives of the General Motors Corp. at the dinner that marked the dedication of GM's "Highways and Horizons" exhibit at the New York World's Fair.

Left to right are Charles F. Kettering, Mr. MacDonald, William S. Knudsen and Alfred P. Sloan. (Left)

Lammot duPont, right, president of E. I. duPont de Nemours & Co., is shown chatting with Ernest T. Weir, executive of the National Steel Corp., as they attended GM's dedication dinner. (Lower right) Previewers are inspecting the novel automobile which will be part of the GM exhibit. The fenders, hood and body panels of the car are made of transparent plastic to reveal body construction details.



International

Firestone Employees Urge Company To Drop Negotiations With URW

Association Claims That CIO Group Represents Less Than Five Per Cent of Workers in Akron

The Firestone Employees Protective Association has petitioned the Firestone Tire & Rubber Co. to suspend collective bargaining negotiations with the Firestone local of the United Rubber Workers Union of the CIO, claiming it represents less than 5 per cent of Firestone workers in Akron. URW officials have been in conference with Firestone officials since April 1, discussing terms of a new contract to replace the present Firestone-URW contract due to expire April 30.

The Employees Protective Association is pushing its claim before the National Labor Relations Board for a new col-

lective bargaining election at Firestone. A year ago the URW won collective bargaining rights over the association by a close margin.

URW spokesmen state that inasmuch as the URW is still the collective bargaining agency, it will push its negotiations with the Firestone management.

The association's request that contract negotiations be halted was contained in a letter addressed to W. R. Murphy, the company's labor superintendent, and signed by F. A. McDonald, president of the group.

McDonald said that the petition for

an election filed with the NLRB on March 29 alleged that Firestone local now represents less than 5 per cent of the company's employees and that the association represents a majority of the employees.

A similar petition for an election by the Akron Goodyear Employees Association has been pending in the NLRB files since last November, but board attorneys have pointed out that the Goodyear situation is complicated by the fact that the Goodyear local, URWA, has filed charges against the company, which include allegations against the association. No such charges are pending at Firestone.

Yellow Truck Reports Profits of \$388,779

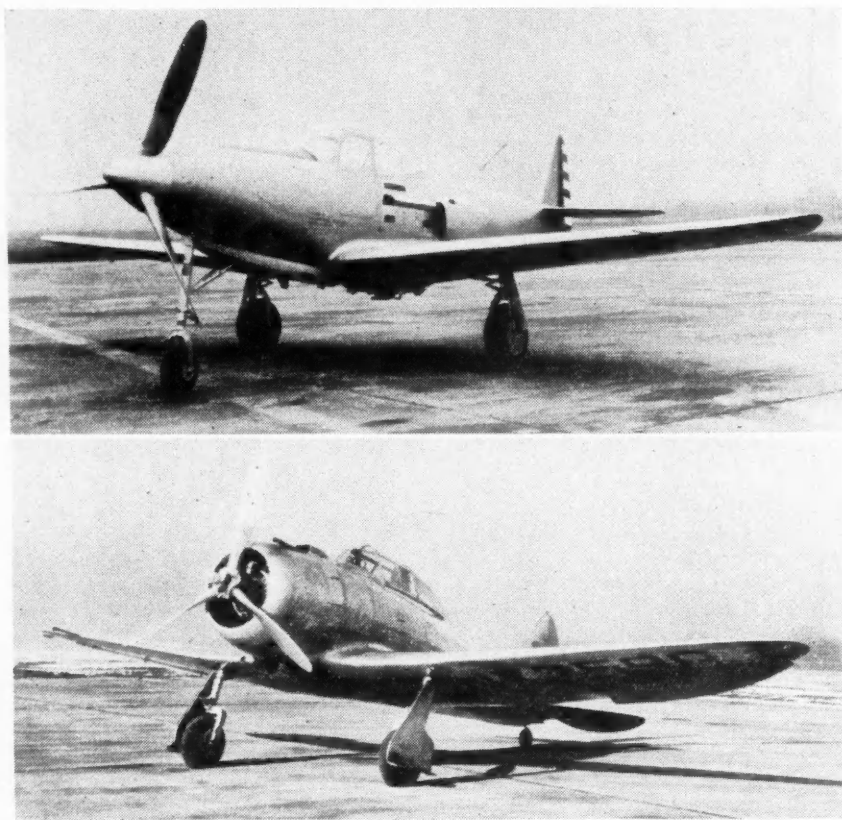
Net sales of Yellow Truck & Coach Mfg. Co. for the quarter ended March 31, 1939, were \$13,325,658. The consolidated net profit for the quarter ended March 31, 1939, amounted to \$388,779, after deducting provision for depreciation of \$282,571 for plants and equipment and provision for Federal taxes on income of \$130,000. The above compares with net sales of \$13,465,032 and a net profit of \$117,575 for the quarter ended March 31, 1938.

Borg-Warner Acquires "PESCO" Organization

The Borg-Warner Corp. has acquired the Pump Engineering Service Corp. of Cleveland, and now operates this concern as a subsidiary. The Cleveland company has been, for several years, manufacturing aviation parts known by the trade name, "Pesco."

The present organization will continue to operate the business headed by William S. Jack, one of the firm's founders, as president. Other officers of the company are J. P. Johnson, vice-president and chief engineer; William R. Jack, treasurer, and Ralph H. McQuat, secretary and general manager.

PESCO products are manufactured in Great Britain by the Plessey Co., Ltd., of Ilford, England, which has been licensed to produce the equipment for the Air Ministry of Great Britain, and for the various airplane manufacturers in Great Britain.



International

Latest Additions

Two new experimental pursuit planes just purchased by the U. S. Army. The plane shown at the top was made by the Bell Aircraft Co., Buffalo, N. Y., and has been designated as the XP-39. This plane has a tri-cycle type landing gear, retractable in flight, and is powered with a single Allison supercharged 12-cylinder engine rated at 1000 hp.

The other plane, made by the Seversky Aircraft Corp., Farmingdale, L. I., N. Y., below, is a single-engine mono-plane powered with a Pratt & Whitney double-row engine, driving a three-blade propeller. It is designated as the XP-41. Both planes were built on Air Corps order and are now undergoing tests at Wright Field, Dayton, Ohio. No figures were released concerning the speed of the planes, but aviation circles believe that the two planes are capable of speeds approaching at least 400 m.p.h.

First Educational Orders Awarded by War Dept.

The War Department has announced award of the first so-called educational orders to be made under the \$10,000,000 program authorized by Congress last June. Enacted to familiarize industry with the Government's war-time requirements, the law authorized the orders to be placed at the rate of \$2,000,000 a year.

The first awards, requiring a total expenditure of the full \$2,000,000 for

the current fiscal year, went to the following companies:

Goodyear Tire & Rubber Co., Akron, Ohio, gas masks; Winchester Repeating Arms Co., New Haven, Conn., new semi-automatic rifles; General Electric Co., Schenectady, N. Y., searchlights; R. Hoe & Co., New York, recoil mechanisms for anti-aircraft guns; S. A. Woods Machine Co., Boston, machining of 75-millimeter shells; American Forge Co., Chicago, forgings for 75-millimeter shells.

The amounts involved in each contract were not disclosed.

Additional trial orders, to be placed under the broadened educational orders program just passed by Congress and calling for expenditures of \$34,500,000 during the next three years, will be made shortly for guns, planes, shells and tanks. Assistant Secretary of War Johnson estimated that these orders will be placed with approximately 270 plants.

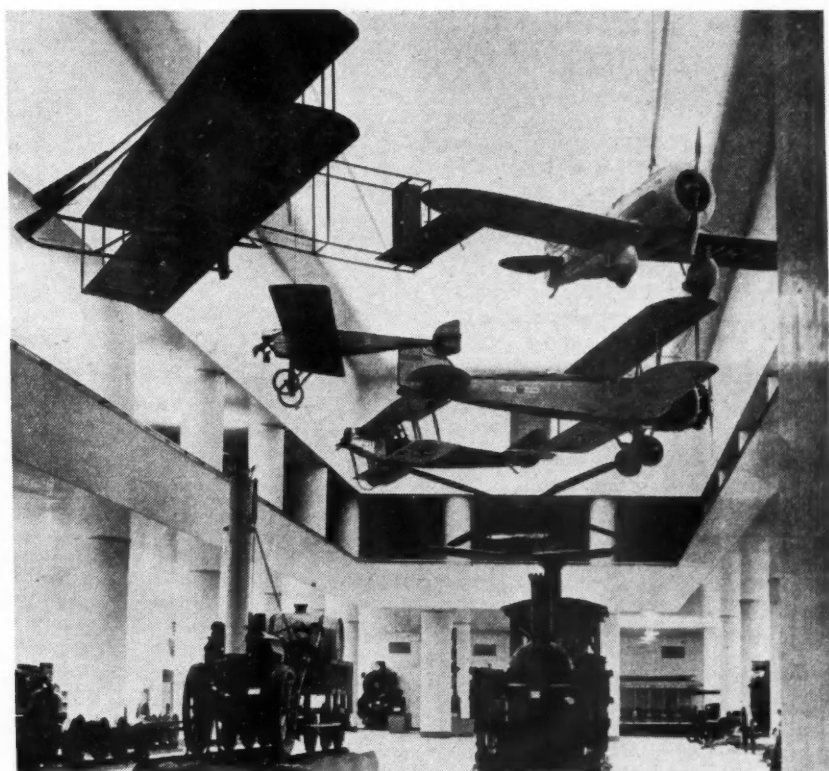
U. S. Tractor Output Down 36.8% in '38

The output of tractors in 1938 declined to a value of \$196,217,993 from \$268,394,076 in 1937 and \$214,853,968 in 1936, according to the Bureau of the Census. Domestic sales in these respective years were \$151,394,914; \$214,192,212, and \$171,850,905.

Exports were valued at \$50,863,452; \$44,663,045 and \$24,779,631. Of the 1938 output the leading type was rubber tire tractors under 30 belt horsepower. There were 85,171 of this type manufactured with a total value of \$53,198,222.

Nelson-LeMoon Truck Buys Federal Branch

Purchase of the Chicago branch of the Federal Motor Truck Co. by the Nelson-LeMoon Truck Co. of Chicago has been announced by K. M. Schaefer, general sales manager of Federal. Business is already being conducted by the new ownership, which is now known as the Federal-LeMoon Truck Co.



Hall of Transportation

View of the Hall of Transportation, a new exhibit of the Rosenwald Museum of Science and Industry in Chicago. On the floor are a replica of Stephenson's Rocket, 1829, and the locomotive built by John Stevens, of Hoboken, N. J. (right), about 1820. Overhead from front to rear are: A Wright Brothers' plane of 1912; Capt. Frank Hawks' Lockheed plane; a tiny Morane-Saulnier of 1913; a Boeing mail plane of 1925; a wartime Jenny; and a Pitcairn autogiro.

One of the biggest transactions in the Chicago automotive trade in recent years, the terms of the deal call for the new company to handle a volume of more than \$300,000 during the balance of 1939. The LeMoon Co., manufacturers of motor trucks since 1906, will cease building trucks and will turn over its entire facilities at 849 N. Kedzie Ave. to the sales and service of Federals.

GM-Cornell Index, 60.4

The General Motors-Cornell World Price Index of 40 basic commodities for the week ended April 15 was 60.4, compared with the previous week's figure of 60.5. The United States index in gold decreased 0.1 point.

Buick Reports Heavy Sales Gain Over '38

Domestic retail deliveries of Buick motor cars during the first 10 days of April totaled 6339 units, a gain of 1875, or 42 per cent, over the corresponding period a year ago.

Used car sales by Buick dealers in the United States during the first April period totaled 10,570 units.

Wickwire Moves Offices Into Larger Quarters

After seventeen years at 41 East Forty-Second Street, New York City, the Wickwire Spencer Steel Co. and its subsidiary, the American Wire Fabrics Corp., have removed their combined general offices and eastern district sales offices to larger quarters at 500 Fifth Ave., New York City.

Passenger Car and Truck Production (U. S. and Canada)

	March 1939	February 1939	March 1938	Three Months	
				1939	1938
Passenger Cars—U. S. and Canada					
Domestic Market—U. S.	279,148	223,748	153,316	766,118	403,485
Foreign Market—U. S.	20,555	16,235	20,749	53,598	65,465
Canada	12,689	10,914	12,276	35,007	37,414
Total	312,392	250,897	186,341	854,723	506,364
Trucks—U. S. and Canada					
Domestic Market—U. S.	57,500	46,368	34,634	152,033	102,451
Foreign Market—U. S.	14,737	11,490	13,096	37,184	46,453
Canada	4,860	3,386	4,526	11,636	13,078
Total	77,097	61,244	52,256	200,853	161,982
Total—Domestic Market—U. S.	336,648	270,116	187,950	918,151	505,936
Total—Foreign Market—U. S.	35,292	27,725	33,845	90,782	111,918
Total—Canada	17,549	14,300	16,802	46,643	50,492
Total—Cars and Trucks—U. S. and Canada	389,489	312,141	238,597	1,055,576	668,346

AUTOMOTIVE INDUSTRIES

*Summary of Automotive Production Activity
(Week Ending April 29)*

BUSES Prospective orders for a considerable number of new vehicles said to be looming in the East have not materialized. Little change reported in manufacturing operations.

TRUCKS Business for several large concerns is said to be "keeping up at a satisfactory rate." One company states that sales are running 15 per cent ahead of last year.

TRACTORS Major companies now see 1939 as "only a fair year." Only one producer reporting this week indicates that business is far ahead of its 1938 mark.

AUTOMOBILES Production for the week ended April 29 was expected to total approximately 85,000 cars and trucks. This will bring the monthly output to approximately 340,000 units.

MARINE ENGINES Recent orders from boat builders have given engine builders an opportunity to build up production accordingly.

AIRCRAFT ENGINES Factories are busy, and backlogs of orders for engines and parts are increasing.

This summary is based on confidential information of current actual production rates from leading producers in each field covered. Staff members in Detroit, Chicago, New York and Philadelphia collect the basic information, in all cases from official factory sources.

(Copyright 1939, Chilton Co., Inc.)

Goodyear Gets Contract For Aircraft Life Rafts

A contract for the production of pneumatic life rafts for the War Department's fighting planes has been awarded the Goodyear Tire & Rubber Co. of Akron.

The award, totaling \$84,800, was confirmed by Louis Johnson, assistant secretary of war, as one of four contracts to four Ohio firms in a \$1,359,761 allotment of orders.

Made of rubberized-fabric, the life rafts have been built for some time by the Akron firm. The contract, however, calls for a special type which will be carried as safety equipment on all military aircraft, it was learned.

When non-inflated the raft is a small, compact bundle. When it is needed, the pilot merely presses a button among his controls, which looses a special gas to inflate the raft in less than one minute.

United Aircraft Reports Profits at \$1,490,799

Net profit of United Aircraft Corp. and its subsidiaries for the quarter ended March 31, 1939, was \$1,490,799.75, which is equivalent to 56 cents per share on the 2,649,437 shares of capital stock outstanding, after provision for Federal and Canadian income taxes and minority interests in the profits of the Canadian subsidiary.

May 22 Set for NLRB Hearings on Goodyear

The National Labor Relations Board will issue a complaint against the Goodyear Tire & Rubber Co., setting May

22 as the time for hearings to begin, it was learned in Akron, April 24.

Disclosure of this fact came as city council received a letter from Max Johnstone, attorney for the board, requesting that council chambers be made available for the hearings.

Johnstone, who has been in Akron for the last four months in charge of the NLRB's investigation of charges made by the Goodyear local, URWA, refused to discuss the complaint, but

indicated that he would have a formal statement later.

The union has alleged that the company has violated the Wagner labor law in several respects. The NLRB also has in its files the petition of the Akron Goodyear Employees Association for an employees' election to determine the bargaining agency at Goodyear.

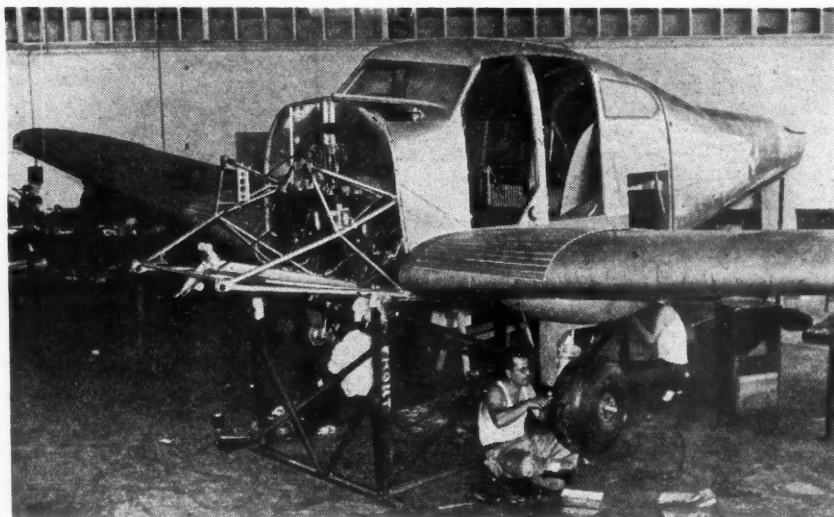
Hudson Announces '39 Convertibles

Hudson has announced two new 1939 convertible cars in several models. Two are Eights and two are Sixes on 122-in. wheelbase in the Country Club series, two are Hudson Sixes on 118-in. wheelbase, and two are Hudson 112 De-Luxe six-cylinder models. Two body types are available, a three-passenger coupe and a six-passenger brougham.

\$1,059,440 for Air Corps And Ordnance Contracts

The War Department has announced awards totaling \$927,593 for equipment for the Air Corps and \$131,847 under the Ordnance Department's special machinery and inspection gage programs.

The following contracts were awarded for the Air Corps: Wright Aeronautical Corp., Paterson, N. J., spare parts and exhaust manifold assemblies, \$162,263; Curtiss Wright Corp., Clifton, N. J., hubs, propellers, boosters, switches and blades, \$94,627; Pittsburgh Screw & Bolt Corp., Pittsburgh,



Acme

Autoplane Nears Completion

"The automobile that flies like an airplane" will be completed within a few weeks. This new "Vega" is being built by a Lockheed Aircraft Corp. subsidiary and is said to be unlike any plane ever made.

The builders claim that the 5750-lb. ship will fly 210 m.p.h. It will have two in-line engines placed side by side. Designed for private use, it will sell for \$27,500, has a tri-cycle landing gear and steel-tube truss construction upon which the cabin shell is mounted. Automobile-like accommodations will be provided for six persons. Specifications call for a 1060-mile cruising range on 160 gallons of gasoline. This ship, 32 ft. 5 in. overall and 41 ft. from wing tip to wing tip, can fly on one engine.



New N.A.D.A. Prexy

Stanley H. Horner, of Washington, D. C., who was elected president of the National Automobile Dealers' Association at the conclusion of the 22nd annual convention in San Francisco April 20.

hubs, propellers, boosters, switches and blades, \$51,300; Hayes Industries, Inc., Jackson, Mich., wheel and hydraulic brake assemblies, \$44,138; Bendix Aviation Corp., South Bend, Ind., wheel and hydraulic brake assemblies, \$21,830; Goodyear Tire & Rubber Co., Akron, Ohio, wheel and hydraulic brake assemblies, \$2,488, and pneumatic rafts, \$84,800; W. F. Hebard & Co., Chicago, tractors and tractor mowers, \$53,305; The Fate-Root-Heath Co., Plymouth, Ohio, tractors and tractor mowers, \$11,128; Pioneer Instrument Co., Inc., Bendix, N. J., oxygen regulator assemblies, \$52,325; Pump Engineering Service Corp., Cleveland, Ohio, vacuum pump assemblies, \$63,675; Keuffel & Esser Co., Hoboken, N. J., drift meter assemblies, \$129,950; Walter Kidde & Co., Inc., New York, oxygen cylinders, \$61,280; Air Cruisers, Inc., Clifton, N. J., oxygen cylinders, \$34,950.

Under the special machinery program these contracts were awarded: The Canister Co., Phillipsburg, N. J., bullet assembly presses (rebuilding), \$15,600; Standard Machinery Co., Providence, R. I., draw presses for bullet jacket, \$5,060; American Broach & Machinery Co., Ann Arbor, Mich., broaching machine, \$23,493; Cincinnati Grinders, Inc., Cincinnati, automatic milling machines, \$7,735, and small automatic milling machine, \$3,285; The Hanson-Whitney Machine Co., Hartford, Conn., thread milling machines, \$19,717; H. R. Krueger & Co., Detroit, multi-spindle drilling and reaming machine, \$19,600; Brown & Sharpe Mfg. Co., Providence, R. I., automatic milling machines, \$4,628, and

small automatic milling machine, \$2,248; Stedfast & Roulston, Inc., Boston, drilling, reaming and counter-sinking machine, \$6,776.

Contracts awarded under the inspection gage program follow: Pratt & Whitney Division, Niles-Bement-Pond Co., Hartford, Conn., gages for fuse setter, \$2,423, and gages for howitzer carriage, \$1,612; Sheffield Gage Corp., Dayton, Ohio, gages for fuse setter, \$5,294, and gages for telescopes, \$1,350; Vinco Tool Co., Detroit, gages for fuse setter, \$2,611, and gages for observation instrument, \$2,326; West and Dodge Thread Gage Co., Boston, gages

for fuse setter, \$4,075; Barwood & Co., Philadelphia, gages for fuse setter, \$1,633; Standard Gage Co., Poughkeepsie, N. Y., gages for range quadrant, \$1,068, and gages for howitzer carriage, \$1,306.

Chevrolet Sales Up 24% First 10 Days of April

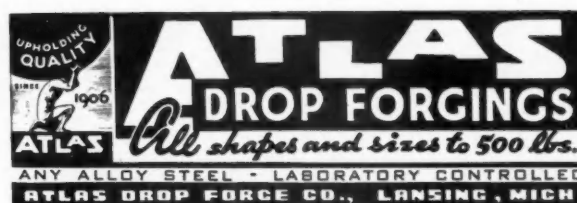
Chevrolet dealers' retail sales of new cars and trucks reached 21,743 units in the first 10 days of April, 24 per cent above the total for the same period last year.



Atlas engineers examine drawings for production economy; chemists and metallurgists, behind test tubes and microscopes, explore into the raw bar steel; others peer through pyrometers into glowing furnaces, watch heat registering meters, scan hardness testing dials, check surface measurements with finely calibrated instruments.

It's all in a day's work at Atlas, for years of doing these things have proven that it pays both Atlas and its customers.

Send Your Drop Forging Problems to Atlas



MEN

Hugh W. Hitchcock has been appointed advertising manager of the Packard Motor Car Co. Mr. Hitchcock has had 17 years of automotive advertising experience, all of it with the Packard company. Starting in 1922 as a clerk in the factory advertising department, he became editor of Packard publications, field correspondent, business manager of the department and, since 1933, assistant advertising manager.

Lothair Teetor has been reelected president of the Perfect Circle Co. Other officers are: Ralph R. Teetor, vice-president; L. B. Davis, secretary-treasurer; and C. R. Teetor, comptroller. Directors of the company are: Lothair Teetor, Macy O. Teetor, Don H. Teetor, Herman Teetor, Ralph R. Teetor, Dan C. Teetor, George H. Keagy, W. B. Hartley, and Wallace Harkrader.

Charles H. Betts has been named assistant sales promotion manager of Cadillac-LaSalle. Mr. Betts, formerly sales promotion manager of the Cadillac factory branch in Chicago, succeeds



● Every minute is *worth* saving in assembly or service adjustments. In precision machine tools, for instance (and in aircraft, where assembly cost is subordinate to accuracy) Laminum shims not only are reducing adjustment time and labor—they afford a degree of precision which makes older methods a costly luxury. ● You simply *peel* laminations (each .003 or .002 inch or less in thickness) from the "solid" brass Laminum shim as required. No filing, grinding, machining!

We furnish Laminum shims—any quantity—cut to your specifications. For maintenance use, Laminum shim stock in sheets is obtainable from your mill supply house.

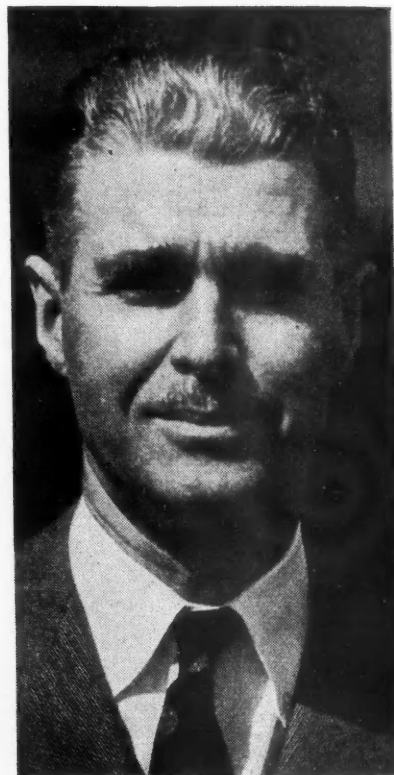
LAMINATED SHIM CO., INC. 21-30 44th Ave., L. I. City, New York, N. Y.
Cleveland Dallas Houston Milwaukee Tulsa

1167

Application Chart FREE
Write us for new file-folder
illustrating the many types of
bearings in which LAMINUM
shims find application. For
handy practical use. With it
a sample of Laminum.



LAMINUM
THE SOLID SHIM
THAT *peels* FOR ADJUSTMENT



Chester C. Coddling

... who has been appointed assistant to the general manager of Willys-Overland Motors, Inc. Mr. Coddling was associated formerly with the DeSoto division of the Chrysler Corp.

Walter Myers who resigned to become associated with Welsh & Triumphfeller, commercial art firm.

Edmund T. Allen, internationally known test pilot and consulting engineer, has joined the Boeing Aircraft Co. as chief of the company's Research Division. In his new post Mr. Allen will be in direct charge of all flight testing, aerodynamics, wind tunnel research and related work.

J. W. Brussel, formerly works manager of the Timken-Detroit Axle Co. and factory manager of Federal-Mogul Corp., has been appointed factory manager of Bendix Products Division, South Bend, Ind.

Vascoloy-Ramet Corp. Opens Eastern Plant

A new plant for the manufacture of tantalum carbide wire, tube, sectional and shape dies, cutting tools and blanks, has just been put into operation by Vascoloy-Ramet Corp., North Chicago, Ill.

The plant, located at 415-421 Tonelle Ave., Jersey City, N. J., occupies an entire one-story brick and steel building of approximately 6000 sq. ft. floor space.

Except for the primary processing of carbide materials which are received from the parent plant at North Chicago, the New Jersey plant is a

complete production unit for Vascoloy-Ramet products, equipped with new and advanced facilities for manufacturing, casing, finishing and recutting all types of sintered carbide dies. Equipment is also to be installed for production, brazing and finishing of blanks and cutting tools.

Operations are under the direction of John Kontra, Joseph Hall and John Adler, who were formerly associated with Union Wire Co., district sales and service are handled by Hayden G. Fulton, transferred from North Chicago, main plant.

Judge Slick Steps Out of GM Case

Judge Thomas W. Slick of Northern Indiana United States district court, South Bend division, has disqualified himself in the government anti-trust case against General Motors Corp. Judge Walter Lindley, of the eastern Illinois district, will hear the case.

The company is charged in a federal grand jury indictment with violating the Sherman anti-trust law through its General Motors Acceptance Corp., which finances the time-payment sale of the General Motors automobiles and trucks. Judge Lindley announced that all motions preliminary to the trial had to be filed in the South Bend district on or before May 1 and that he would hear the motions on May 12 at 10 a.m. preparatory to setting a date for trial.

Judge Slick said he disqualified himself because he had heard the consent decrees of the other two motor concerns, Ford and Chrysler, which were indicted at the same time, and felt that he should not under those circumstances hear the General Motors case.

Nash's Early April Sales 282% Ahead of 1938 Mark

Establishing the highest ten-day sales record since July, 1937, retail sales of new Nash cars during the first ten days of April were up 282 per cent above the like period of 1938. A total of 2917 automobiles were sold at retail during the ten days as compared with 736 cars in the first ten days of April a year ago.

Pontiac Magazine

A new picture magazine published monthly in the interest of Pontiac car owners and called *Pontiac Owners' Magazine* will make its bow in May, according to C. P. Simpson, general sales manager.

Mailing lists are to be kept up in cooperation with Pontiac dealers, the publication to be sent to those Pontiac owners selected by the dealers. It is expected that the first issue will go out to some 300,000 owners.

Monthly Motor Vehicle Production (U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES	
	1939	1938	1939	1938	1939	1938
January	291,444	168,890	62,502	58,262	353,946	227,152
February	250,897	151,133	61,244	51,464	312,141	202,597
March	312,392	186,341	77,097	52,256	389,489	238,597
April	.....	190,111	.....	48,018	.....	238,129
May	.....	168,599	.....	41,575	.....	210,174
June	.....	147,545	.....	41,857	.....	189,402
July	.....	112,114	.....	38,336	.....	150,450
August	.....	61,687	.....	35,259	.....	96,946
September	.....	69,449	.....	20,174	.....	89,623
October	.....	192,906	.....	22,380	.....	215,286
November	.....	335,767	.....	54,638	.....	390,405
December	.....	341,524	.....	65,492	.....	407,016
Total	.....	2,126,066	.....	529,711	.....	2,655,777



Uniform Results... Lower Costs with Ryerson Certified Alloys

You can reduce failures—eliminate spoilage and get better results in less time with Ryerson Certified Alloy Steels. They are from selected heats of steel that meet an ideal specification—a "specification within a specification"—that assures uniform response to heat treatment.

All Ryerson Certified Alloys are analyzed and tested in advance. Special data sheets showing exact chemical analysis, grain size, cleanliness rating, and results of actual heat treatment tests, are prepared and sent with every shipment. You know exactly what you are getting. Your heat treater does not have to test. He takes no chances. Spoilage is eliminated and sound dependable jobs of high accuracy and uniformity are secured.

Ryerson has large and complete stocks of these selected identified alloy steels. They cost no more and quick shipment is assured.

Ryerson Certified Steels also include carbon, tool and stainless steels that meet definite quality standards. They offer many advantages to steel users. Let us tell you the complete story. Write for booklet.

JOSEPH T. RYERSON & SON, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.



RYERSON

German Machinery Exports to Latin America Up 30% in 1938

Now Shipping Almost Twice as Much Metal-Working Equipment to This Market as Does the United States

The Commerce Department's Machinery Division reports that Germany increased her exports of metal-working machinery to the eight most important Latin-American markets by 30 per cent during 1938, and now ships almost twice as much of this equipment

to these countries as does the United States.

Germany's 1938 sales, the Department reports, were valued at \$4,088,294 as compared with \$3,151,591 in 1937. Sales by the United States were valued at \$2,093,632 in 1938 compared with



**ONLY LAPPING As Strom Does It
CAN PRODUCE SUCH PRECISION**

Strom Steel Balls possess a degree of surface smoothness and sphericity that has never been equalled in any other regular grade of ball. Such precision is exclusive with Strom because it can be attained only through a series of lapping operations such as are standard practice in the Strom plant.

Physical soundness, correct hardness, size accuracy and sphericity are guaranteed in all Strom Balls.

Other types of balls—*stainless steel, monel, brass and bronze*—are also available in all standard sizes.

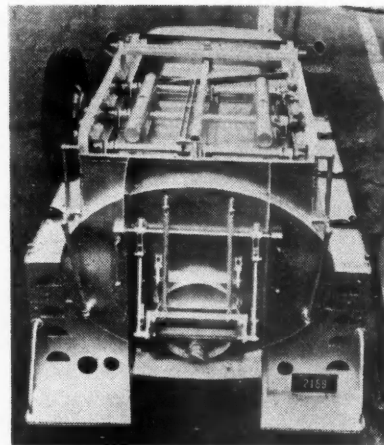
Write for complete details.

Strom

STEEL BALL CO.

1850 So. 54th Avenue, Cicero, Ill.

The largest independent and exclusive Metal Ball Manufacturer



Acme

Fishbowl

This is the first of eight trucks that were delivered by a Seattle, Wash., concern to the U. S. Bureau of Reclamation, April 18. They will be used to transport live salmon, trapped below Rock Island Dam in the Columbia River, to upstream points for river-stocking purposes. Each truck has a 1000-gallon tank and motor-driven equipment that will aerate the water and cool it to "destination temperature" while the fish are enroute.

U. S. sales of \$2,297,345 in 1937.

Brazil is the principal South American importer of metal-working machinery. Argentina is second.

A report issued by the Civil Aeronautics Authority clearly indicates that Italy and Germany have made serious inroads into our aircraft markets in Latin America, and that the Orient was the principal customer for American aeronautical products during 1938.

Of the total amount of aircraft and aircraft accessories exported last year, 41 per cent, shipments valued close to \$28,500,000, went to the Far East, as against 19 per cent, or \$12,600,000, to Latin America.

German and Italian shipments of aircraft to Chile, Paraguay, Peru and Brazil in 1938 totaled \$6,400,000, more than 50 per cent of all the Latin American trade secured by U. S. exporters during this period. Chile alone imported German and Italian aircraft last year worth 54 times the value of their purchases from the United States. In 1938, American exports of aeronautical products to that country were valued at \$64,331, as compared with nearly \$2,300,000 from Germany and \$1,200,000 from Italy. Paraguay purchased aircraft from Italy in the amount of \$1,000,000 and \$6,162 from the United States. The Peruvian market amounted to more than 3½ times the value of equipment purchased from this country. American exports to Peru were reported worth \$223,490, while corresponding shipments from Italy totaled \$811,355.

Argentina and Brazil remain our best customers in the South American territory. In 1938 our shipments to the former country aggregated nearly \$6,200,000, and to the latter about \$2,

000,000. During the same period Mexico purchased upwards of \$1,200,000 in aircraft and aircraft products from United States manufacturers.

Foreign aircraft shipments from all the principal producing countries throughout the world last year were valued at approximately \$150,000,000, as compared with \$82,200,000 in 1937, an increase of 73 per cent during the year. The United States' share in this international trade in 1938, including all aircraft parts, instruments, engines and parachutes, amounted to \$68,200,000 or 45.6 per cent of the total, as compared with \$39,400,000 or 45.7 per cent, during the previous year. Thus, while the actual value of our aeronautical exports increased 73 per cent from 1937 to 1938, the proportionate share of our world trade in aircraft remained practically unchanged.

Aircraft exports from the United Kingdom rose from \$18,200,000 in 1937 to \$26,400,000 in 1938, an increase of 45 per cent; while German aircraft exports advanced from \$14,900,000 in 1937 to \$27,200,000 in 1938, an increase of approximately 82 per cent.

The combined value of the exports from the United States, the United Kingdom and Germany last year equaled about 82 per cent of the total international trade in aircraft. Czechoslovakia ranked fourth as an exporter of aircraft in 1938, accounting for 6.4 per cent of the world trade in aeronautical products, while Italian exports aggregated 4.9 per cent; similar shipments from France totaled 2.5 per cent; from Canada, 1.9 per cent, and from Switzerland, 1.2 per cent.

Japan was the leading aircraft market during 1938 for both American and German equipment. United States' exports to Japan increased from \$989,100 in 1936, to \$2,500,000 in 1937, rising to an all-time high of \$11,000,000 in 1938. German aircraft exports to Japan increased from about \$943,092 in 1937, to \$3,100,000 in 1938.

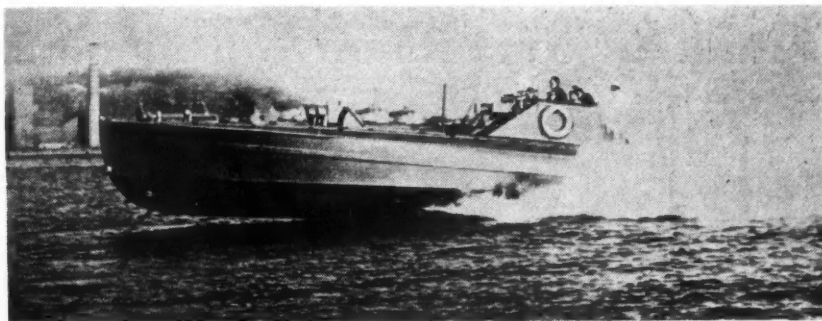
PUBLICATIONS

A catalog of its complete line of air motored agitators, both direct and gear driven, has been published by the Pneumix Division of Eclipse Air Brush Co., Inc., Newark, N. J.*

Latest forms of Leeds & Northrup Co. apparatus for all well-established electrolytic conductivity measurements are described in catalog EN-95 issued by this company. In addition, the publication includes a general discussion of these measurements and illustrates suggested combinations of equipment for proposed applications.*

Two new bulletins have been brought out by Rivett Lathe & Grinder, Inc. No. 505-E covers the company's series No. 505 of plain precision bench lathes and hand screw machines furnished in various collet capacities with bronze, ball and roller spindle bearings; the lathe attachments, and the mountings and drives. Bulletin 130 illustrates and describes a new universal milling attachment designed for use on any make of precision lathe.*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.



Aetna

For the "Mosquito Fleet"

The first of 30 high-speed torpedo patrol boats of the Philippine Islands "Mosquito Fleet." The craft is 55 ft. long, has an 11-foot beam and a speed of 45 knots. She carries torpedo tubes, mounted machine guns and can carry mine-laying equipment.



Manufacturer Controls Temperature LONG AFTER THE SALE IS MADE

● Dole Thermostats for motor temperature control are typical of the many devices by which a positive automatic response to heat and cold can be pre-determined. The manufacturer's interest in his motor, for example, does not end with good performance on the testing block. He wants to assure good performance under all conditions, thereby increasing his reputation and his sales. A thermostat in the block promises this . . . and a Dole Thermostat, as a majority of automotive manufacturers have learned, will deliver most dependably.

Engineers are using Dole Thermostatic Bi-Metal in devices of their own development for automatic temperature response. We furnish it in sheets, fabricated parts ready for assembly, or we complete the device, as desired. Our engineering and manufacturing departments are available to assist you. Write us.

THE DOLE VALVE COMPANY, 1901-1941 Carroll Ave., Chicago, Ill.
Detroit Office: 2-137 General Motors Bldg.

DOLE

Thermostats

AND THERMOSTATIC BI-METALS

Final Arguments on GM and Ford "6%" Cases Set for May 2 and 4

*Ourselves and Government—A Check List
Of Federal Action Corrected to April 27*

FEDERAL TRADE COMMISSION

VS. UNITED STATES RUBBER CO. and its subsidiary, U. S. Tire Dealers Corp. Cease and desist order under Robinson-Patman Act announced April 28, requires discontinuance of alleged price discrimination and payment of

special commissions in sale of automobile tires and tubes.

MANUFACTURER-DEALER INVESTIGATION. Report of the \$50,000 inquiry into the distribution methods of automobile manufacturers and dealer relations under the Withrow resolution passed by Congress a year ago is due

to be made public by the FTC soon. It had been expected on April 13, but for some unannounced reason the report had been delayed. The Commission was given a year to complete the inquiry, but no definite time was specified for a report to be made to Congress.

FAIR TRADE PRACTICE RULES. Introduced at public hearings during the December, 1938, meeting of the NADA in Detroit, the rules are still pending although the Commission has been expected to make them public since early in January.

F.O.B. PRICE CASE. Hearings on GM case concluded the first week in April. An answer to FTC charges is due to be filed. A similar case, involving the Ford Motor Co., and charging that price advertising is misleading is also pending.

SIX PER CENT CASE. Final arguments in the General Motors Case scheduled for May 2 in Washington; and in the Ford case for May 4. The Commission has charged the two companies with allegedly false and misleading representations in advertising finance plans.

GENERAL MOTORS EXCLUSIVE DEALER CASE. Hearings were scheduled to resume in Pittsburgh on Monday. FTC alleged GM dealers were required to handle only GM parts.

DEPARTMENT OF LABOR

STEEL WAGE CASE. A temporary injunction granted by the District of Columbia Court of Appeals and restraining the Secretary of Labor from enforcing the provisions of her steel wage decision is still in effect. The secretary last December prescribed a minimum wage ranging from 62½ cents in the East to 45 cents in the South for steel companies doing Government business.

Because of current wage scales it is considered unlikely that the Department will seek to prescribe minimum wage standards for the automobile industry. However, that was the forecast with respect to the steel industry a year ago, and the Department instituted proceedings at the request of the Steel Workers Organizing Committee, CIO affiliate.



YOUNG

**HEAT TRANSFER PRODUCTS
AND ENGINE COOLING**

The Young Radiator Company has consistently through good times and bad, developed its manufacturing facilities and research to attain a standard in efficiency and design heretofore unmatched. Innumerable Young radiators, coolers, heaters and copper heat transfer products in service throughout the world cooling gas, gasoline or Diesel engines give Young engineers a knowledge and understanding of the needs and requirements of operators of power machinery. This manufacturing and engineering service is available to you in working out your cooling problems. Send us your problems—a qualified engineer will call on you with no obligation.

**YOUNG RADIATOR
Company**
RACINE WISCONSIN

Young Quality

ABSTRACTS

Ignition Qualities Of Hydrogen

For a long time it was the general belief that hydrogen was a highly detonating fuel and that this quality was due to a low temperature of ignition. Evidence to the effect that at least the second of these assumptions is incorrect was given at a meeting of the Internal Combustion Engine Group of the Institution of Mechanical Engineers in

(Turn to page 578, please)

CONSIDER THESE LUBRICATION ADVANTAGES of the TORRINGTON Needle Bearing



THOROUGH, efficient lubrication with little service attention is an important advantage inherent in the design of the Torrington Needle Bearing. The turned-in lips of its hardened retaining shell form a reservoir that holds plenty of grease or oil for long periods of operation. Rotation of the rollers constantly supplies lubricant to the rotating shaft.

Consider the advantages of these features in a typical application, taken directly from the files of our Engineering Department. In the knitting machine

cam roller assembly illustrated, the plain bushings formerly used required *daily* lubrication. The Torrington Needle Bearings now used *in the same service* need lubrication only *twice a year*. Note, too, how easily the product design was adapted to incorporate the Needle Bearings in place of the bushings.

Adaptable to Varied Lubrication Requirements

The Needle Bearing is equally well suited for applications requiring special lubrication because of speed and load conditions. The bearing can be supplied with an oil hole, which makes it readily adaptable to gravity feed or pressure lubrication systems. Moreover, the lips of the Needle Bearing fit closely to the shaft, aiding in the exclusion of dirt and other

foreign matter. The Needle Bearing is ideally suited to high-speed operation at heavy radial loads, as its many linear inches of contact give high load capacity.

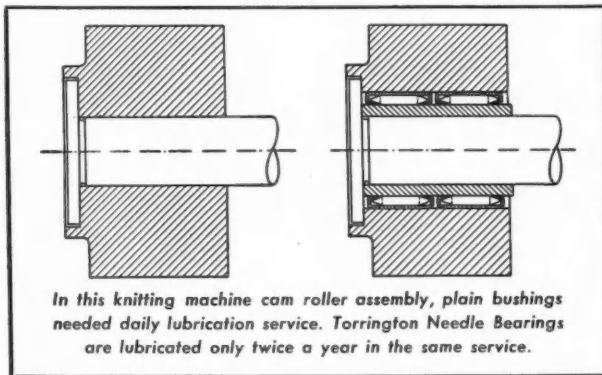
You can obtain these advantages in your own product at surprisingly little expense, because the Needle Bearing is low in unit cost and easy to assemble. The Torrington Engineering Department will cooperate with you in laying out applications utilizing the advantages of this unusual bearing.

For further information, write for Catalog No. 7. For Needle Bearings to be used in heavier service, request Booklet No. 103X from our associate, Bantam Bearings Corporation, South Bend, Ind.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.

Makers of Ball and Needle Bearings

Branch Offices in all Principal Cities



TORRINGTON NEEDLE BEARING

Abstracts

(Continued from page 576)

London on March 28, in a paper on "A New Injection System for Gas Engines" by R. A. Erren and in the discussion thereof. Wing-Commander Cave-Brown-Cave in the discussion gave some details of the system of burning hydrogen discharged from the gas cells of the British dirigible R-101, in the Diesel engines of that airship. He mentioned that in the flight to Egypt (in the course of which this dirigible was wrecked) the R-101 would have con-

sumed approximately 25 tons of fuel, and to keep its buoyancy constant, it would have been necessary to discharge one million cubic feet of hydrogen gas. If such a quantity of hydrogen were burned in the cylinders of the engine, power equivalent to that of 4-5 tons of liquid fuel could be generated, and the trip therefore could be made with 20 instead of 25 tons of liquid fuel.

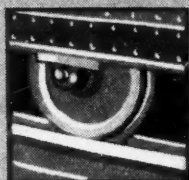
As regards the method of utilizing the hydrogen gas in the engine, down pipes 3 ft. long were arranged on the inlet side, with inlet valves at the top. Hydrogen was supplied to the engine at slightly above atmospheric pressure,

and the feed therefore was constant on the time basis. The more the supply to the pipes was opened, the more hydrogen got in, and the hydrogen valve was interconnected with the fuel-control valve of the Diesel engine, so that as the rate of hydrogen supply increased, that of liquid fuel decreased. It was thus possible to replace almost the whole of the liquid fuel with hydrogen and still maintain the same power output. Although the hydrogen was introduced with the air during the induction stroke and the engine operated with a compression ratio of 16 there was no preignition. This was definitely proven in a test in which the proportion of hydrogen was made larger and larger, until the oil was entirely shut off. The engine then slowed down and stopped, and that without back-firing.

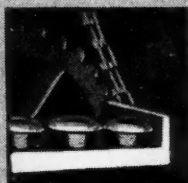
Mr. Erren confirmed the statements with regard to the failure of hydrogen-air mixtures to ignite spontaneously under compression. He said the ignitability of the gas depended on its purity, its dryness, and on the degree of heat of the ignition source. As long as oil was injected, that acted as the igniter, but when the oil was cut off, the hydrogen from the cells of the dirigible, owing to its dryness, would have a very high temperature of ignition.—*The Engineer*, April 14.

ADD *improved* dag TO YOUR H-T LUBRICANTS

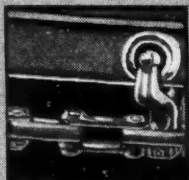
REDUCES CARBON, FLAKE-OFF AND WEAR



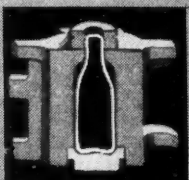
KILN CAR
BEARINGS



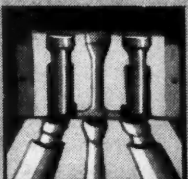
OVEN
CHAINS



CONVEYOR
CHAINS



GLASS BOTTLE
MOLDS



DIE-CASTING
MOLDS

Users of glass and ceramic machinery, conveyors, bakery ovens, projectors, die-casting equipment, and other mechanisms in which high temperatures are encountered, are finding lubricants containing "dag" colloidal graphite the ideal solution to their lubrication problems.

Now available in smaller particle size, "dag" furnishes stable suspensions in *volatile* petroleum and other fluids. Thus, with the quick evaporation of the carrier fluid, a dry lubricating film of pure "dag" colloidal graphite is left.

Combining physically with metal surfaces without dusting or flaking off, "dag" is chemically inert, non-gumming, odorless, impervious to oxidation, economical . . . AND RETAINS ITS LUBRICATING PROPERTIES UNCHANGED under all operating conditions.

A note on your letterhead will bring Technical Bulletin 130 containing details on the use of "dag" for high temperature lubrication.

"Dag" colloidal graphite is furnished in concentrated form especially suitable for blending in H. T. lubricants. We will gladly show your oil supplier how he may blend "dag" with his present oil.

ACHESON COLLOIDS CORP.
PORT HURON, MICHIGAN



CALENDAR

Conventions and Meetings

- Chamber of Commerce of the United States, Annual Meeting, Washington, D. C. May 2-4
- American Roadbuilders Association, Annual Meeting, San Francisco, May 7-10
- The National Battery Manufacturers Association, Spring Convention, The Greenbrier Hotel, White Sulphur Springs, West Virginia May 11-12
- American Foundrymen's Association, Forty-third Annual Convention, Cincinnati May 15-18
- SAE World Automotive Engineering Congress May 22-June 8
- National Metal Trades Association, Annual Meeting, Chicago . . . May 24-25
- American Iron & Steel Institute, Annual Meeting, New York City . . May 25
- American Society for Testing Materials, Annual Meeting, Atlantic City June 26-30
- Automotive Engine Rebuilders Association, Seventeenth Annual Convention, Baltimore, Md. July 5-7
- National Petroleum Association, Annual Meeting, Atlantic City, Sept. 14-15
- American Welding Society, Annual Meeting, Chicago Oct. 22-27
- American Trucking Association, Annual Meeting, Chicago Oct. 23-24
- American Petroleum Institute, Annual Meeting, Chicago Nov. 13-17
- National Independent Traffic League, Annual Meeting, Chicago . . . Nov. 23-24

Shows at Home and Abroad

- Great Britain, London, Automobile Show Oct. 12-21
- Italy, Milan, Automobile Salon, Oct. 25 to Nov. 11
- International Automobile, Motorcycle and Motor Boat Show, Budapest, Oct. 27 to Nov. 6
- Great Britain, London, Commercial Automobile Transportation Show, Nov. 2-11
- Great Britain, Glasgow, Scotch Automobile Show Nov. 10-18

ADVERTISING

Joseph A. Martz, formerly with Buchen Co., Chicago, as an account executive, has joined Studebaker Corp. to do customer relations and research work.

Paul W. Garrett, director of public relations, General Motors Co., will deliver the keynote address of the Advertising Federation of America convention, June 18 to 22, New York.

Simplex Products Corp., and Accurate Parts Mfg. Co., are among the advertising accounts signed up by Fred G. Knapp, who has organized an advertising agency in the National building, Cleveland.

F. W. Munro, formerly with Graham-Paige Motors Corp., and Hupp Motor Car Corp., has joined the advertising department of Plymouth Motor Car Corp.

Open letters are being used in newspapers to assure the automobile-buying public that there are no overcharges or hidden charges in Commercial Credit Company's financing charges. The letters are signed by A. E. Duncan, chairman. Other large finance companies will soon begin similar campaigns, Kenneth C. Watson, the company's director of public relations, indicated.

Advertising policies of automobile manufacturers were blamed by the National Automobile Dealers' Association for the "chaotic conditions" in the industry, and the organization adopted a resolution urging fair trade as a logical remedy. W. E. Blanchard, general manager of the association, said that the price problem is interlocked with advertising, and that dealers must be given a voice in advertising policies if price reform is to be achieved.

Car Makers to Aid ICC in Rate Study

All passenger car manufacturers will cooperate in supplying to the Interstate Commerce Commission information on shipping rates and practices in connection with a sweeping investigation of rates charged by the nation's carriers of passenger automobiles from factory to dealer, which starts with hearings beginning in Chicago on June 13.

Exhaustive information regarding rates, earnings and competitive practices has already been sought from all carriers through a preliminary questionnaire, and the general purpose of the investigation will be to determine whether a general rate structure should be set up under government auspices to avoid alleged destructive competition between rail, water and highway carriers.

Automobile manufacturers are interested parties as important users of all three forms of transportation, and their cooperation in contributing information

for the purposes of the study was agreed upon after a conference with the commission by James S. Marvin, manager of the traffic department of the Automobile Manufacturers' Association, regarding information desired voluntarily from the passenger car makers.

"This investigation by the commission of our industry's shipping rates may result in the fixing of minimum rates under which no common or contract carrier can quote, and also in requiring that rail, truck and water rates be 'related,'" Mr. Marvin said.

The commission has announced that

parties from all sections of the country have indicated an interest, and that the proceedings are open to all for any issues that they desire to raise within the province of the commission, but so far as now appears the principal issues will probably respect maximum and minimum rates and the relation, if any, to be prescribed between the rates of the several agencies of transportation to avoid alleged destructive competition. For instance, it may be contended by some that the rates by trucks should be the same as the rates by rail, and by others that they should be certain amounts higher or lower.

PAC MAKERS

Speed Up

Your Production with

BAL-CUT LEADED STEELS

You buy the proper gas to get the most out of your motor car . . . so why not use the right steel to get the most out of your screw machine equipment.

BAL-CUT Leaded Steel is ideal for modern high-speed automatics. Its cutting rate averages 30% to 60% greater than for standard screw stock.

It gives maximum machine efficiency . . . which means not only better machinability, but also increased tool life and longer runs on every job.

You may be able to substitute BAL-CUT in place of your present screw stock, and gain important economies. It is available in all standard SAE grades . . . both Bessemer and Open Hearth.

Try an order of BAL-CUT Cold Finished Bar Steel . . . and profit by its greater productivity.

COLD DRAWN BARS
•
GROUND SHAFTING
•
LEADED STEELS
•
SCREW STOCK
•
ALLOY STEELS

BLISS & LAUGHLIN, INC.
HARVEY, ILL. BUFFALO, N.Y.
Sales Offices in all Principal Cities

Steel Mill Operations Affected By Lack of Orders from Car Makers

*Bought Most of '39 Stock at "Low" Prices
Now Recognized That Large Automobile Concerns*

Paucity of orders from automobile manufacturers together with the desire to conserve coal brought makeshift adjustments in steel mill operations this week, a more definite program for meeting prevailing problems being hardly possible until the outlook is

somewhat more clear. So far shipments have not been affected by the coal miners' strike; in fact, rolling mills, because of the shrinkage of their order books, just add incoming business to their current schedules, and extraordinarily prompt shipments are the usual

result. Here and there blast furnaces are being banked as a precautionary measure in the event that settlement of the coal strike should take longer than is generally expected. The resulting curtailment in the supply of primary steel is, however, no greater than the dip in the demand for finished steel.

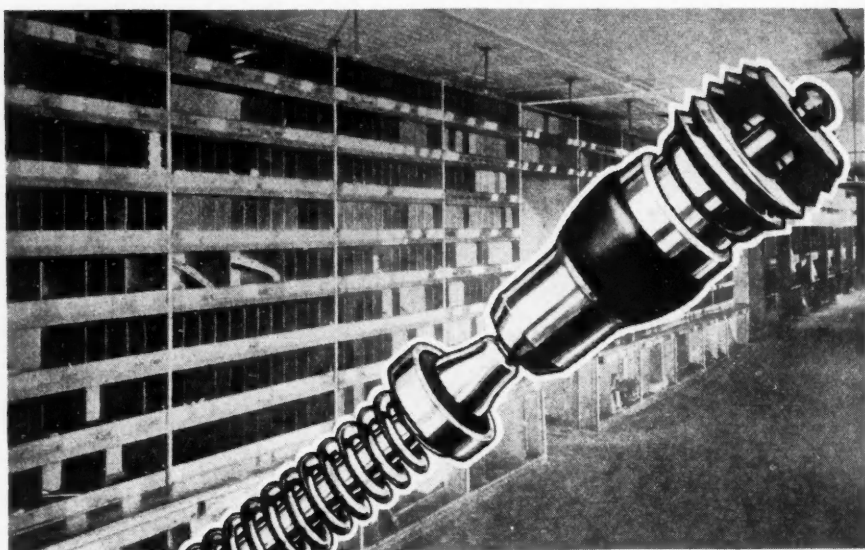
According to the American Iron & Steel Institute, operations this week have receded to 48.6 per cent of ingot capacity, the lowest rate in nearly seven months, the Christmas week of 1938, which brought a dip to 38.8 per cent, having been the only period of lighter operations in that time. There is a relatively fair demand for steel bars for trucks and tractors, but only small lot buying of sheets and strip steel. It is now clearly recognized that the large automobile manufacturers were able to cover the bulk of their body stock requirements for 1939 models at lower prices than those now nominally in vogue, and what their attitude toward prices will be, when the next buying movement gets under way, is expected to determine the steel market's future course.

Tin is now selling at around \$45 a ton over the price levels of a month ago. Consumers covered their nearby needs before the price of spot Straits crossed 48 cents. On Tuesday sellers asked 48½ cents. It is surmised that tin producers are jockeying for position in the event that the pending negotiations for the barter of wheat and cotton for tin and rubber should be consummated. The prevailing market price is certain to be at least an ingredient in whatever yardstick is fashioned for the swap. The political upheaval in Bolivia had no effect on the tin market. Bolivian supplies may become very important in an emergency, but ordinarily play a minor role in the tin market. They were of great help in the World War as a means of piecing out the supply received from the Straits Settlements and the Dutch East Indies.

A fair volume of routine orders for automotive brasses is reported to have come out this week. The Connecticut Valley fabricators are operating at better than one-half of capacity. The market for spot electrolytic copper, following withdrawal of sellers at 10 cents, turned firm at 10¼ cents, with one mine producer later advancing his price to 10½ cents.—W. C. H.

Mass Production of New Ford Tractor Announced

Henry Ford announced on April 27 that the Ford Motor Co. would begin mass production of a new farm tractor at once. The new tractor, which has been known to be underway for some time, incorporates a plowing system invented by Harry Ferguson, of Belfast, Ireland, employing a hydraulic lift which keeps the implement being pulled at a constant level as the tractor moves forward.



REPLACEABLE
like any other part of the car

The stock department of any car dealer is mute evidence of the need for replaceable parts. But no dealer could possibly carry a complete assortment of every part for even one year's models. However, dealers, garages and service stations the country over can conveniently carry all the parts necessary to service any Schrader-Type Tire Valve. Schrader Valve Cores and Caps will fit all standard tire valves regardless of the age, size or valve or tire.

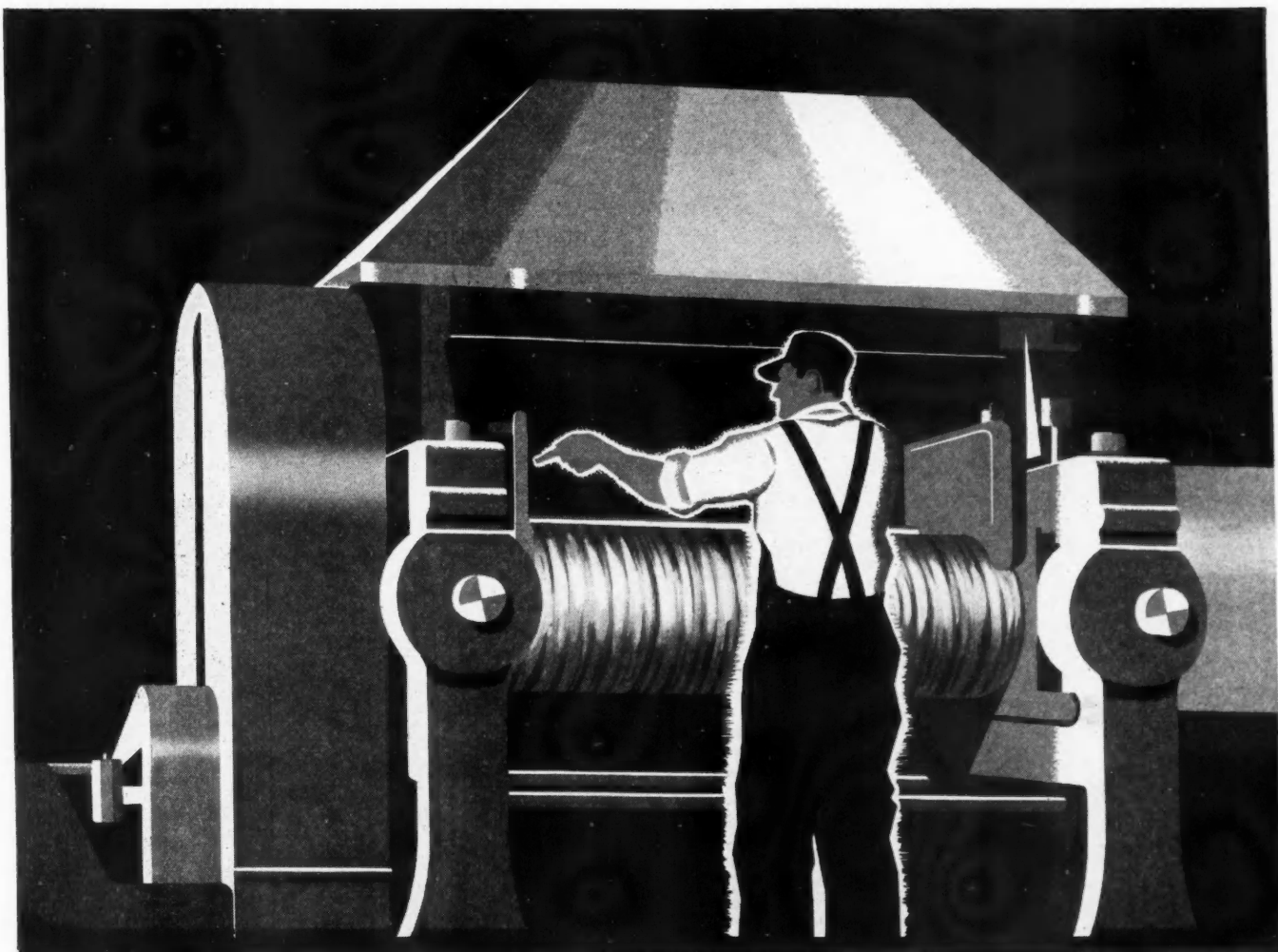
A. SCHRADER'S SON, BROOKLYN, N. Y.
Division of Scovill Manufacturing Company, Inc.

Schrader
REG. U.S. PAT. OFF.
TIRE VALVES

THE STANDARD FOR EQUIPMENT AND REPLACEMENT

The far-sighted principle of the standard Schrader Tire Valve permits replaceability and economy in keeping with modern standards of automotive design.





CAST IRON AND CONFIDENCE

A Molybdenum addition to cast iron has often proved the best way to get the most out of money spent to improve materials.

The selection of a gray cast iron with 0.75% Moly for 64-inch rubber mill drives is a typical example. The Moly iron is strong (a test showed 61,000 p.s.i.) and tough enough to stand severe service. Despite the necessary hardness, machining presents no difficulties.

Thus full advantage is taken of the economy of cast iron, without sacrifice of performance capacity.

This is only one of the many cases in which Molybdenum iron has brought about a combination of economy with dependability. Investigation may show that you can apply it with advantage. Our technical book, "Molybdenum in Cast Iron," is free to interested production executives and engineers on request.

PRODUCERS OF FERRO-MOLYBDENUM, CALCIUM MOLYBDATE AND MOLYBDENUM TRIOXIDE

Climax Mo-lyb-den-um Company
500 Fifth Avenue • New York City

Estimated Dealer Stocks of New Passenger Cars

1938	January	February	March	April	May	June
Production—U. S. Domestic Market†	130,273	119,696	153,316	160,028	140,239	123,333
Retail Sales—U. S.‡	126,442	120,348	188,325	193,392	187,306	155,811
Change in Inventory.....	+3,831	-452	-35,009	-33,364	-47,067	-32,478
Inventory, first of month.....	408,157	411,988	411,536	378,527	343,163	296,096
1938 (continued)	July	August	September	October	November	December
Production—U. S. Domestic Market†	96,975	53,955	60,177	171,371	295,366	305,900
Retail Sales—U. S.‡	153,426	123,711	90,629	134,984	241,009	241,623
Change in Inventory.....	-56,451	-69,756	-30,452	+36,387	+54,357	+64,277
Inventory, first of month.....	263,618	207,167	137,411	106,959	143,346	197,703
1939	January	February	March	April	May	June
Production—U. S. Domestic Market†	263,232	223,746				
Retail Sales—U. S.‡	180,651	165,995				
Change in Inventory.....	+82,581	+57,753				
Inventory, first of month.....	261,980	344,561	402,314			

†—U. S. Census Bureau.

‡—Automobile Manufacturers Association.

Crosley Car

(Continued from page 567)

on semi-elliptic springs in front and one-quarter-elliptic springs in the rear, rubber-bushed shackles being used. The car is equipped with four Delco-Lovejoy shock absorbers. A rigid frame with channel-section side members is employed.

An outstanding feature of the car is its fuel economy, which results from its low weight, small piston displacement, and thorough streamlining. Sixty miles to the gallon is said to have been recorded in tests at 30 m.p.h., and it is claimed 50 miles per gallon is obtainable by running in the recommended top cruising range of 40-45 m.p.h. The gasoline tank holds 4 gals. and the crankcase takes 2 qts. of oil.

The Crosley has a wheelbase of 80 in. and an overall length of 120 in. Its overall height is 54 in. and its ground clearance 7½ in. Attention is called to the relative roominess of the car. Mr. Crosley stands 6 ft. 4 in., and he insists there is ample leg room in the little car for him. An adjustable driver's seat is provided and is believed to solve an important problem relating to comfort.

Cars are finished in gray, yellow or blue, with black tops and red wheels. A deluxe model listing at \$350 f.o.b. Richmond, Ind., carries additional equipment.

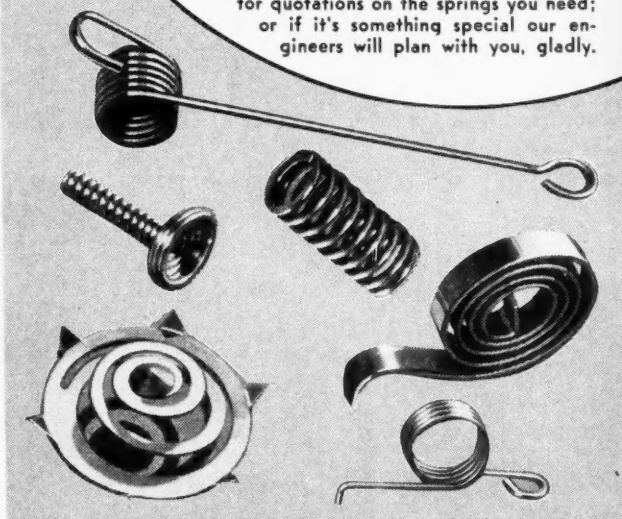
Associated with Mr. Crosley in the mechanical development of the car were L. C. Oswald, chief engineer, and S. F. Clifton.

The 25,000 Crosley radio and refrigerator dealers will be offered dealerships, as well as others who may show interest in the new car.

Fired with the ambition to become an automobile manufacturer, Mr. Crosley in 1909, only a few years after completing his studies in engineering and law at the University of Cincinnati,

You'll profit by using ACCURATE Springs—Every kind for every purpose

WHETHER the springs you use are simple, standard types—or need special engineering—make sure they have the advantage of being Accurate made. A lot of quality and service can be packed into a tiny, hair-like coil. For instance: extra life may be assured by more careful finishing; and perfect uniformity doesn't just happen—it's achieved—by rigid inspection, testing of materials, and control of production methods. When you wisely choose Accurate Springs and find their difference in quality, remember those are some of the "reasons why" they're not just ordinary springs. Into every Accurate product—springs or wire forms—is built the same reliability and guarantee of service. Use them to your advantage . . . it pays to say "Accurate". Ask today for quotations on the springs you need; or if it's something special our engineers will plan with you, gladly.



COMPRESSION
SPRINGS
•
EXTENSION
SPRINGS
•
TORSION
SPRINGS
•
FLAT SPRINGS
•
WIRE FORMS
•
STAMPINGS
•
CARBON STEEL
•
VANADIUM
STEEL
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STAINLESS
STEEL
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BRONZE
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BRASS
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MONEL METAL
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OTHER ALLOYS

ACCURATE SPRING MANUFACTURING COMPANY

3811 W. Lake Street, Chicago, Illinois

SALES OFFICES

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Detroit, Michigan111 E. 4th St.,
Cincinnati, Ohio3645 College Avenue,
Indianapolis, Indiana

Underwood and Underwood

Powell Crosley, Jr.

organized a company to build a car of an advanced design. He had had some experience in demonstrating and selling cars during his college days. Later he joined Carl G. Fisher in Indianapolis and then became assistant general sales manager for the Parry Automobile Company, a car-manufacturing concern. Next he was with the National Motor Vehicle Co. in Indianapolis as assistant sales manager in charge of sales promotion and advertising.

His next connection was with the Interstate Car Co., which concern he left to engage in the advertising business. In 1916 he organized a mail order automobile accessory business and somewhat later engaged in the manufacture of phonographs, from which he branched out into the manufacture of radio sets. He has also been successful as a manufacturer of refrigerators, is head of radio broadcasting station WLW in Cincinnati, and owner of the Cincinnati National League Baseball Club.

NLRB Hears Additional Testimony from Ford

The National Labor Relations Board heard testimony last week that the Ford Motor Co. regards portions of the board's findings covering alleged unfair labor practices at the River Rouge plant as a "distortion of evidence."

Referring to the NLRB findings, which recommended that the company withdraw recognition of the Ford Brotherhood of America, Mr. Frederick H. Wood, counsel for the company, told the board that there was no evidence his company had "anything to do with the organization of the Ford Brotherhood."

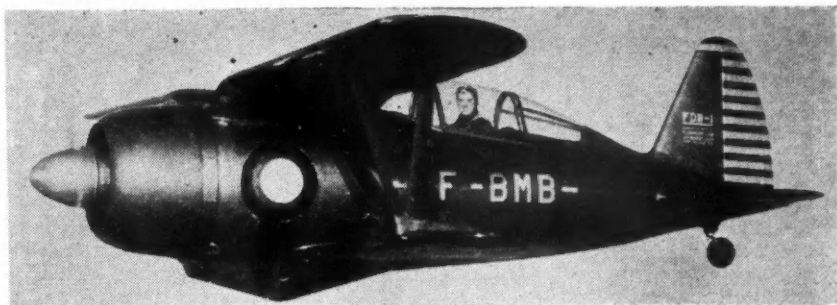
As to that part of the board's findings which recommended an abandonment of vigilante or similar groups, Mr. Wood said there was no foundation for the proposed order and that the only evidence was that three men were reminded by a superintendent or foreman of sit-down strikers in General Motors and Chrysler plants and asked to join a group of employees to eject sit-down strikers if a sit-down strike took place in the Ford plant. He contended there was nothing unlawful about organizing the groups for the purpose of ejecting sit-downers.

40 YEARS AGO

News comes of important developments at Detroit, Mich. The Olds motor carriage and the Olds stationary and marine gasoline engines are to be manufactured there on a very large scale.

The officers of the new company are: S. L. Smith, president; Ransom E. Olds, vice-president and manager, and F. L. Smith, secretary and treasurer. It is said that by August 1, 150 hands will be employed.

From *The Horseless Age*, May, 1899.



International

A 575-M.P.H. Dive

New fighter-bomber plane, with test pilot George Ayde at the controls, which was tested recently before Canadian Air Force authorities in Montreal.

MODERN TIMING REQUIREMENTS *Demand* CHAIN DRIVES...

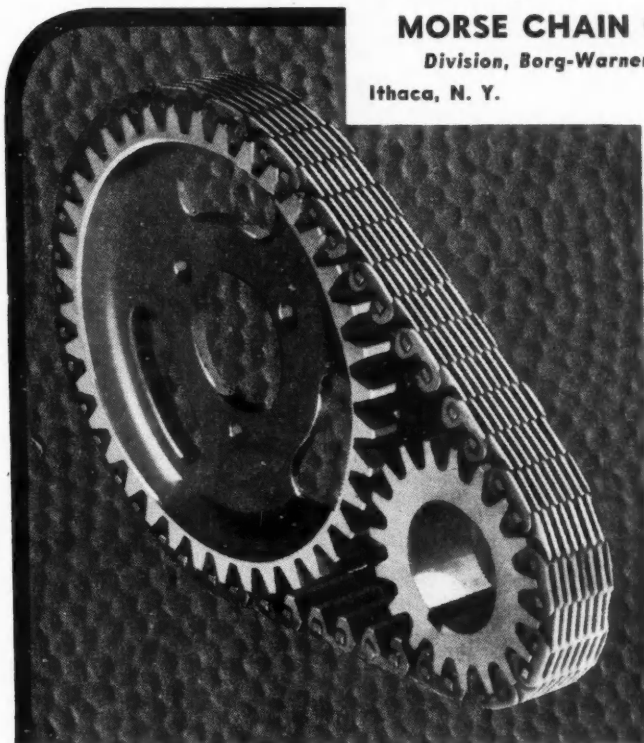
THE smooth, velvety action of Morse Timing Chains softens the feel of the modern high-speed, high-compression engine. For more than a quarter century, every advancement in motor design has been anticipated and accommodated by the basically sound principle of Morse design.

MORSE CHAIN COMPANY

Division, Borg-Warner Corporation

Ithaca, N. Y.

Detroit, Mich.



MORSE

Super-Highways Are Not a Sound Solution to Problem, Says Report

Bureau of Public Roads Gives This Conclusion In Its Comprehensive Study of Toll Highways

The Bureau of Public Roads, in a forward-looking report on highway development to meet increased traffic flow, recently reported to Congress that toll highways cannot be relied upon as a sound solution of providing adequate highway facilities or to solve any con-

siderable part of the problem.

In a comprehensive study authorized by the Federal Aid Highway Act of 1938, the Bureau, basing its estimates on three East-West and three North-South express highways costing on the average of \$184,050,000 annually, con-

cluded that a direct toll system would not be feasible as a means of recovering the entire cost of the facilities. It estimated that the maximum amount of traffic which reasonably could be expected to use the highways would yield \$72,140,000 per year from 1945 to 1960, assuming an average rate of toll at 1.5 cents per vehicle-mile for all vehicles.

If it is the desire of Congress to authorize an actual test, the Bureau said, it is recommended that construction be undertaken over a route where there is "a reasonable prospect" for recovering the costs. It proposed a highway connecting Washington, D. C., and Boston, Mass., and cited one other road where it said that annual toll collections for the year 1960 would slightly exceed the annual cost. This was the 172-mile stretch between Philadelphia and New Haven, Conn., where it is estimated that the revenue in 1960 would represent a combined average of 106 per cent of the estimated cost for that year.

Almost apologetic for its adverse report on the super-highway plans, which have found ardent supporters on Capitol Hill for many years, the Bureau recognized that its report should be constructive rather than negative and outlined a "master highway plan" calling for:

(1) The construction of special, direct inter-regional highways with necessary connections through and around cities and designed to meet requirements of national defense and increasing peace-time traffic of longer range.

(2) Modernization of the Federal-aid highway system.

(3) Elimination of hazards at railroad grade crossings.

(4) An improvement of secondary and feeder roads properly integrated with land-use programs.

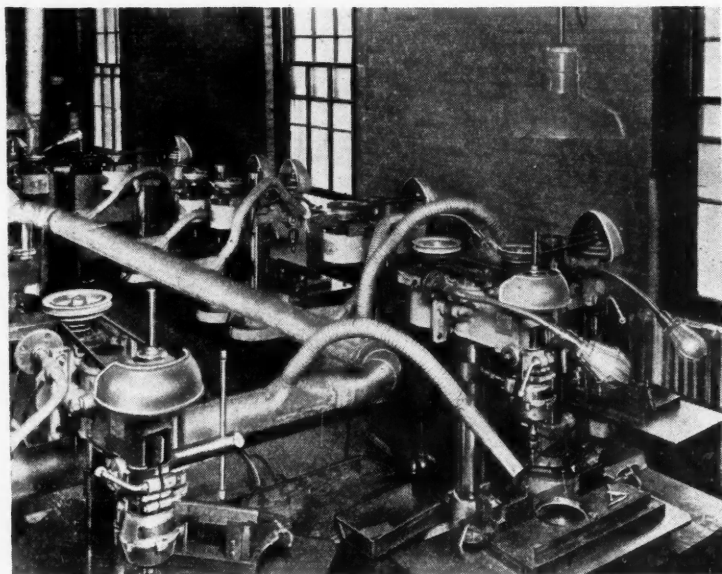
The 212-page report recommended for heavy traffic the divided four-lane highway, and expressed the view that three-lane roads might well lead to an abnormally high accident rate. It disclosed that it had undertaken a detailed study covering the location of toll stations, lighting, signs, landscape development, protection, fencing, and the problem involved in seeking rights-of-way.

"The demonstrated improbability of a return from tolls sufficient to recover the costs of constructing and operating six transcontinental highways, such as were described in the Federal Aid Highway Act of 1938, results from the consequences of direct toll impositions," the report said.

FTC Order Against Two Tire Companies

Alleging violation of the Robinson-Patman Act, the Federal Trade Commission last Friday issued a cease and desist order against the United States Rubber Co., and the U. S. Tire Dealers Corp., New York, requiring discontinuance of alleged price discriminations and payment of special commissions in the sale of automobile tires and tubes.

How To Cut YOUR EQUIPMENT COSTS



Do you want to speed up production and reduce costs—without investing many thousands of dollars for new machinery? Here's a practical suggestion: There are many operations in your shop that can be handled more efficiently and economically by low-cost tools—by Delta drill presses that cost from \$26 to \$275, Grinders, from \$46 to \$84, Metal-Cutting Band Saws at \$79.50. Thousands of America's leading industrial concerns, including the largest, are using Delta low-cost tools to

cut their equipment costs. Huge automotive factories, aviation and motor plants, small part makers, plastic plants—every conceivable type of manufacturing plant is found on the list of Delta low-cost tool users. If these concerns can use low-cost tools to advantage—so can you!

DELTA MFG. CO. INDUSTRIAL DIVISION
689 E. Vienna Ave. Milwaukee, Wis.

Send for Catalog

giving list of users, detailed descriptions of the complete Delta line and prices—and full information on how you can try any Delta tool in your shop without cost or obligation.



Industrial Division
DELTA MFG. CO., 689 E. Vienna Ave.
Milwaukee, Wis.
Gentlemen: Send me latest Delta Catalog.

Name.....
Address.....
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"...shaves over 300 gear types

with only
14
cutters..."



USING Michigan 860 type gear finishers, FULLER MFG. CO., producers of bus, truck and industrial transmissions, and special gearing, has found that with but 14 cutters it can shave every one of its more than 300 'active' gear types at a lower cost than for finish hobbing or shaper-cutting . . . while obtaining the greater quietness, greater accuracy, longer life, and faster production, which characterize MICHIGAN-shaved gears.

Combined set-up time for gear shaver and MICHIGAN gear checking equipment for each new run at Fuller, averages only 30 or 45 minutes, depending on whether or not cutters are changed.

Regardless of your production quantities, if you are interested in better gears at a lower cost, it will pay you to investigate MICHIGAN gear finishing equipment . . .

Bulletins available on Rack-shavers (high production); 860 shavers (job lots); Checking equipment; lapping machines; Cone area-contact worm gearing; gear cutting tools.

MICHIGAN TOOL COMPANY, 7171 E. McNichols Rd., Detroit, Mich.

BOOKS

L'AUTOMOBILE — IL CONTRIBUTO ITALIANO ALL'AVVENTO ED ALLA EVOLUZIONE DELL'AUTOVEICOLO (*The Automobile — Italian Contributions to the Conception and the Development of the Motor Vehicle*), by Giovanni Canestrini. Published by Reale Automobile Club D'Italia, Rome.

This is the first volume of a set of three which is designed to set forth the Italian contributions toward the de-

velopment of the automotive vehicle in both its earlier and later stages. In an introduction written by Alberto Bonacossa, an official of the Royal Italian Automobile Club, complaint is made that in works on automobile history published outside of Italy, whereas Bacon and Newton are mentioned as precursors—early writers who referred to the possibility of mechanical locomotion—Leonardo and Galilei are omitted, and while among the pioneers of the combustion engine and motor vehicle, mention is made of Lenoir, Otto and Marcus, De Cristoforis, Barsanti and Bernardi are ignored.

This first volume deals with develop-

ments prior to about 1890, a period which from the standpoint of motor-propelled road traffic on a commercial scale must be considered as prehistoric. It concerns itself with the development of the wheel and the road, with early developments in mechanism, with the beginnings of the combustion engine and with the first applications of this type of engine to road vehicles.

Various hypotheses as to the origin of the wheel are discussed and the discussion is illustrated by the reproduction of Egyptian frescos and illustrations of wheeled charts from the tombs of the Monarchs of antiquity. Maps are reproduced of Roman roads in various European countries, in Western Asia and in Northern Italy, and some excellent photographs of the remains of such roads in various countries are shown. In the section on early mechanical developments the achievements of Archimedes, Leonardo da Vinci, Galileo, Torricelli, Volta and other Italian scientists are set forth, while in the section on the advent of the combustion engine the contributions of DeCristoforis, Barsanti, and Matteucci are recounted. In the section on the application of mechanical power to road vehicles the first steam and gasoline automobiles built in Italy, by E. Riva and Enrico Bernardi respectively, are illustrated and described. For Bernardi it is claimed that he was first to work out a rigorous solution of the problem of pivotal steering, which appeared in the Transactions of the Royal Venetian Institute of Science for 1896.

A bibliography and a list of patents relating to mechanical road vehicles issued in Italy between 1850 and 1900 conclude the book, the latter being included to "dispose once for all of the legend, so widespread in foreign countries, that Italians took up motor vehicle development only at a relatively late date."

The volume under review is a very impressive production. It contains 600 9½ by 13-in. pages (weighing nearly 8 lb.) and is profusely illustrated.

Fair's Biggest Stunt

(Continued from page 553)

move from one speed lane into the next. Paralleling the 50-mile lanes and separated by wide grass strips are two lanes where the speed is 75 miles per hour. Adjoining these with another grass strip intervening is a single 100 mile per hour lane. These compose the motorway . . . four 50-mile lanes, two 75 mile and one 100 mile. Cars are at definitely spaced intervals, controlled by radio-activated beams sent from the rear of cars to instrument panels of following cars. The minimum spacing is set at 600 ft. on the 100-mile lane, 300 ft. on 75-mile lanes and 150 ft. for cars moving 50 miles per hour.

The spectator approaches a clover-leaf intersection of the 1939 type where two secondary roads cross each other. A moment later there is the 1960 variation in sight in the "Futurama" with traffic moving safely and easily in four



ARE PRECISION MADE FOR PRECISION WORK

FOR TOOL AND DIE MAKERS—or any operation requiring a high powered unit that will not stall. Designed and engineered to give you plenty of power and speed. Built to the most precise specifications to give you long life and trouble-free service. It's ideal for grinding, polishing, scratch buffing, and many other operations requiring power and speed combined.

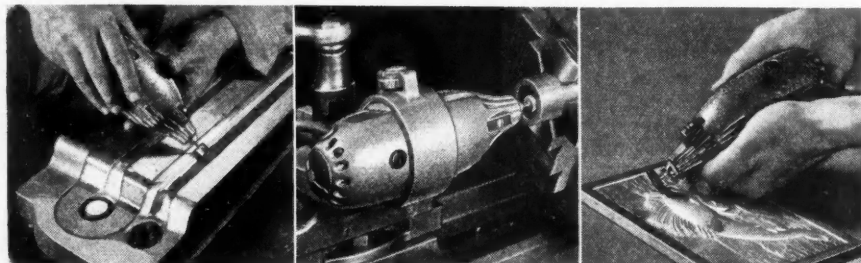
NOTE THESE SUPERIOR CONSTRUCTION FEATURES: Powered with a genuine General Electric full Universal motor, running 24,000 RPM and developing over 40 watts output (not watts input—actually up to 5 times the power delivered by other Grinders in this price field). Equipped with New Departure sealed Precision Ball Bearings. Threaded type collet chuck. Patented spindle lock for easy change of cutters. Fan cooled, it will not get hot. Grueling tests show that this Duro Grinder will run cool, without loss of speed or power for a longer period than any mechanic will ever require of it. Carry it from job to job; just plug into light socket. Order one or more today on ten-day trial, money back basis. Price \$14.95.

Manufactured by
The Makers of America's Finest and Most Complete Line of Power Driven Machinery

DURO METAL PRODUCTS CO.

Dept. PT-1 2663 N. Kildare Ave.,

CHICAGO, ILLINOIS



directions both right and left turns being made on the 50-mile lane without diminution of speed. This compares with 10 miles per hour on the usual cloverleaf of today. To make a right turn on the motorway, a car in a 50-mile lane goes over a ramped loop, or a left turn swings the car to a lane running out on the other side and over a ramp. The high-speed lanes are uninterrupted, as cars must begin swinging into the slower speed lanes by degrees as they approach a turning off point.

Highway lighting of 1960 is indicated. Headlights of cars are extinguished on the motorway. From separators a flood of light spreads across the traffic lanes, below the eye level of drivers. This is done with continuous tube lighting in the separators (in principle not actually in the Futurama). The illumination is automatically controlled by the passing car, so the roadway ahead of a car is always illuminated for a distance equal to two-thirds minimum car spacing and the lights are extinguished behind the car as it travels along. Where traffic is light there will be dark unilluminated spots between cars, or groups of cars.

As the "Futurama" climbs into a mountainous section at 15,000 ft. elevation, the spectator discovers such heights have been conquered by even the 100-mile lane of the motorway with roads never exceeding a grade of 4 per cent. The best grades in general use in the United States today are about 8 per cent. A suspension bridge carries the motorway over a river, the design of approaches eliminating "bottlenecking." Finally the spectator soars over a city of 1960 and then down to a street intersection with elevated sidewalks and the traffic on the lower level. Around a short dark curve and the spectator is looking out on a full-sized model of the same street intersection. Within the buildings are dramatic displays of General Motors products; engineering and chemical facts being demonstrated; a theater where the research department presents daily scientific shows. There are ultra-modern lighting effects, gold and silver murals on black plastic painted by a leading mural painter, Dean Cornwell, and generally enough of interest to keep the spectator busy for several hours, unless he still insists on searching for 1939 model fan dancers in the entertainment section.

But it is this "Futurama" ride that promises to make millions of Americans think about highways and automobiles, and a few of Norman Bel Geddes' thoughts on the subject are likely to be both enlightening and convincing. He views these motorways of 1960 (according to the exhibit) as logical developments based on trends that are evident in motor car design and mechanical construction. Says Mr. Geddes: "The automatic device is dependable. We know how it will act, and how it must act at the press of a button."

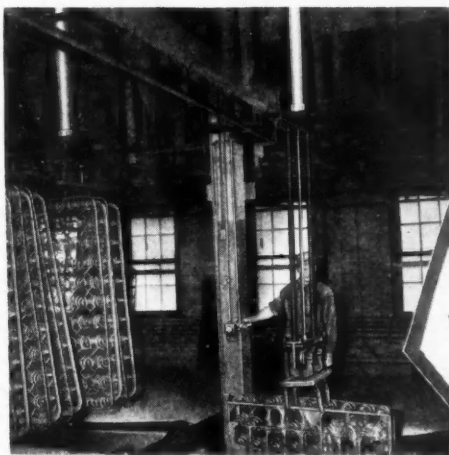
Of the driver on the motorways of the future in the automobiles of that

date and model, he points out that he "is the same unpredictable fellow who clattered off in his horseless carriage thirty years ago. . . . We cannot remodel the driver, but just as we have developed cars with engines that start at the press of a button, we can design machines for automatic driving."

He suggests that automotive manufacturers can begin even now to adapt to the motor car, knowledge that we not only have but are applying to other forms of transportation. There is the "dead man's stick" used for years on subway and elevated trains to stop the

train when pressure is removed from the control lever. There are radio contacts with planes by special beams, railroad block systems that could be adapted to future motorways with the aid of the photo-electric tube. Certain electric locomotives today have pick-up panels for signals from the track circuit. With proper equipment an entire train may be controlled in a stretch of track in this way. "Automatic control over driving," says Mr. Geddes, "is no more ambitious an undertaking than has already been accomplished in evolving the car of today."

75% Time Saving WITH CURTIS' AIR HOISTS



Harris-Hub Bed & Spring Co. speeds up paint dipping and cuts costs with four Curtis Hoists.

Eighteen months ago the Harris-Hub Bed and Spring Company installed four Curtis Air Hoists to replace hand-operated windlasses for dipping bed springs in paint baths. The result was a 75% saving in time. Not a cent has been spent to date for repairs, although the hoist illustrated is used about 250 times a day. Curtis Air Hoists were chosen because of their low cost, rugged simplicity and smooth operation.

Your plant probably has one or more jobs which can be done more efficiently and at less expense with

Curtis Air Hoists. First cost is little more than a chain block. Installation is easy, and regular shop air lines are used. Curtis Air Hoists are immune to injury from overloads or bad atmospheric conditions, power consumption is small and maintenance negligible. They can be operated with ease and accuracy by unskilled labor. Capacities from 1/4 to 10 tons.

Check your plant to see where you can save money with Air Power. Send coupon below for our booklet, "How Air is Being Used in Your Industry."

CURTIS

Compressors • Air & Hydraulic Cylinders
Air Hoists • I-Beam Cranes & Trolleys

CURTIS PNEUMATIC MACHINERY CO., 1917 Kienlen Ave., St. Louis, Mo.
Gentlemen: Please send me your booklet, "How Air is Being Used in Your Industry," and further information on Curtis Air Hoists.

Name _____ Street _____
Firm _____ State _____
City _____

Biggest Automobile Show

(Continued from page 540)

in machine tools. It is a latent factor in the broader progress of all machinery of production.

D. J. CAMPBELL, president, Campbell, Wyant & Cannon Foundry Co.

Our recent contributions to the industry have been in refinements in metallurgical processes for casting crankshafts, camshafts, centrifuge brake drums and sleeves, and new al-

loyed steels. For control purposes in continuous pouring we have adapted spectrographic methods to replace the slower chemical analyses with gratifying results.

LEON R. CLAUSEN, president, J. I. Case Co.

We might say that the whole of the farm equipment business is a contribution toward higher standards of living.

We are constantly striving for improved machinery to continue the same process as described and, in addition, have developed new tools and machinery so as to spread the benefits of better methods to a greater variety of farms. For example: The small combine harvester, the small tractor now becoming highly developed, the tractor mounted plows, cultivators, listers and planters, which were a very recent development with tractor-drawn and tractor-mounted harvesting machinery, all of which make more efficient carrying on of farm work.

K. T. KELLER, president, Chrysler Motor Corp.

Fluid Drive is a method of transmitting power from the engine to the rear axle without the usual continuous mechanical connection. Chrysler Corp. engineers are the first to develop this coupling so that it is practical for mass production. Its effect on transportation should be far-reaching.

Oilite is an oil-filled, oil-cushion bronze made of finely powdered copper, tin and solid lubricants so processed that the finished product is a bronze of great strength and high lubricating value. The discovery by Chrysler engineers opens the way for new and wide applications of powder metallurgy.

Amola is a fine-grained, alloy steel using in its manufacture a definitely controlled ratio of molybdenum, silicon, and aluminum. Not only developed by Chrysler Corp. engineers but also the method by which it is made.

Superfinish, developed by Chrysler engineers, is a new mechanical method of finishing metal of any shape or size so that in less than one minute surfaces can be made on which there are no scratches or marks more than a few millionths of an inch deep.

GUY W. VAUGHAN, president, Curtiss-Wright Co.

Most significant recent new accomplishments in my organization which promote safety and economy and have outstanding economic and social importance include improvements such as anti-stall wings, tell-tale instrument panel for pilot aid, improved safety, also dynamic engine mount for vibration elimination. Reversible pitch propellers and engines of higher performance, greater economy of operation and greater factors of safety.

GERARD SWOPE, president, General Electric Co.

High powered steam turbine electric locomotives for railroads.

The new highly efficient fluorescent lamp, the high intensity mercury lamp and the incandescent projector lamp, which greatly enlarge the field of illumination.

Sodium vapor lamps for more efficient and safe lighting of highways.

A new insulated enameled wire "Formex" with heat, water and acid-resisting properties, which will supersede present enameled wire.



**QUALITY,
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Spicer has had a long and honorable association with the automobile industry. The name **Spicer** on power transmission equipment means unquestioned reliability, highest quality.

More and more, leading manufacturers of passenger cars, trucks and buses are standardizing on **Spicer** equipment—for safety, efficiency and economy.



Experience specifies **Spicer**.

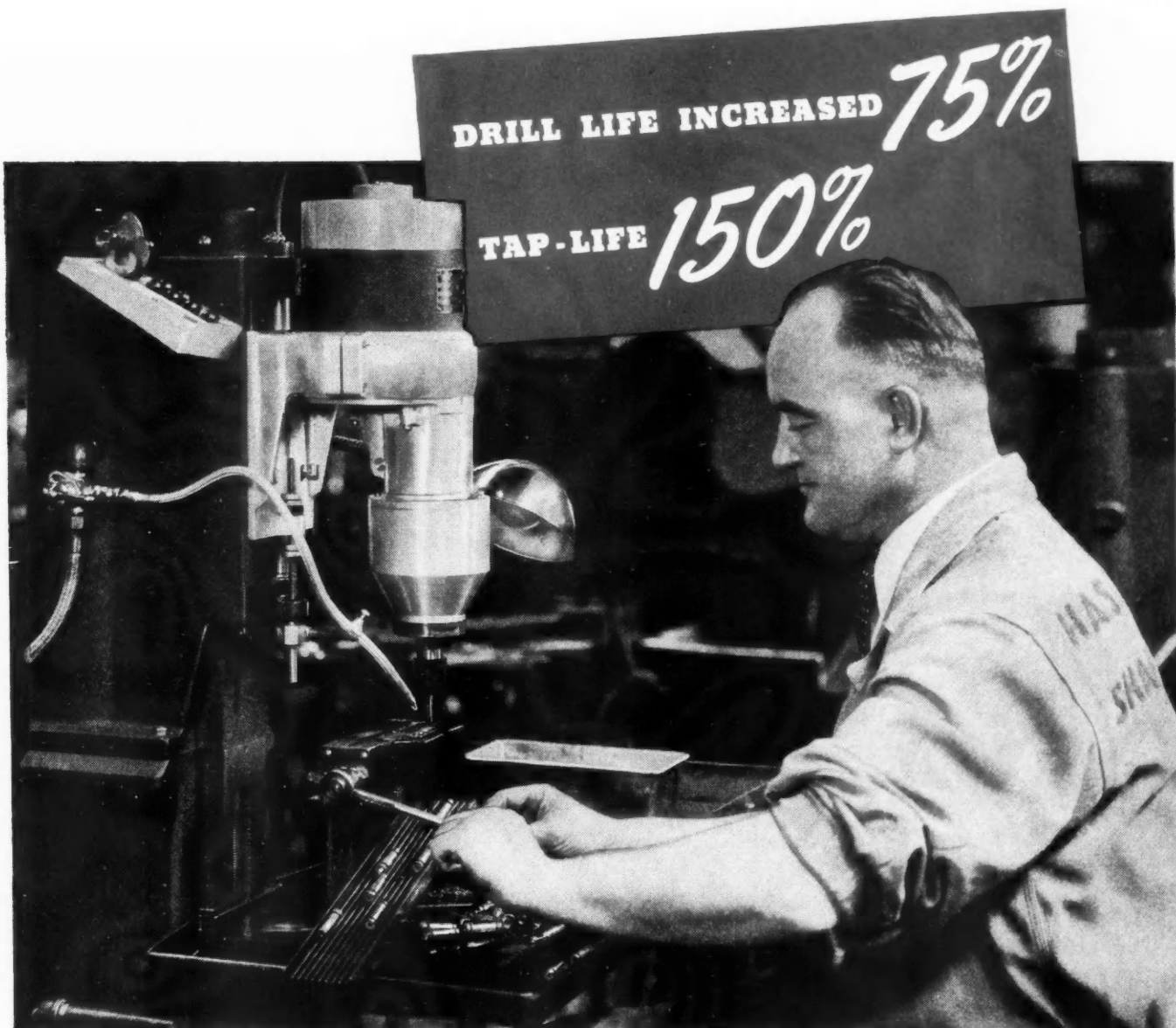
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Tapping blind holes in this thin-wall nickel-iron requires quality in the tapping machine, the tap and in the cutting fluid. This Haskins No. 2 High Speed Tapping Machine increased tap life 150% when used with Texaco Sultex Cutting Oil.



Tiny Ferro-Nickel piece brings out cutting oil performance...

USING A 4-SPINDLE DRILLING SET-UP, drilling nickel-iron containing 40-50% nickel, the best production per set of eight drills was 2800 pieces.

Switching cutting oils, the life of eight drills shot up to 4900 pieces. The oil that brought this 75% increase in drill life was Texaco Sultex Cutting Oil.

Tapping this same ferro-nickel piece in a Haskins No. 2 High Speed Tapping Machine, output per tap held to 2400 pieces.

Again, switching from the cutting fluid they thought best, output per tap immediately went up to 6000 pieces. The oil that gave this 150% increase was Texaco Sultex Cutting Oil.

To get your machining operations on a more efficient basis, get in touch with Texaco. Trained engineers are available to help you select and apply any of 350 Texaco Products. To order, phone the nearest of 2229 Texaco warehouses, or write The Texas Company, 135 East 42nd Street, New York City.



TEXACO

CUTTING and SOLUBLE OILS

Texaco Dealers invite you to tune in The Texaco Star Theatre—a full hour of all-star entertainment—Every Wednesday Night—Columbia Network—9:00 E.S.T., 8:00 C.S.T., 7:00 M.S.T., 6:00 P.S.T.

A fireproof insulation for cables—"Flamenol."
Invisible or non-reflecting glass.

HARVEY S. FIRESTONE, JR., vice-president, Firestone Tire & Rubber Co.

Significant of its extensive research and development activities, Firestone has introduced a host of new and diversified rubber and latex products, each opening a new avenue to industrial and economic progress.

Airtex, a new aerated latex material, signalizes a new era in upholstery.

Development of the multiple injection process of molding plastic articles of large size has increased immeasurably the scope of the utility of plastics.

An interesting new development in the automotive field is the Firestone airspring, which makes it possible to cradle the motor car entirely on air.

H. H. DOEHLER, chairman of board, Doehler Die Casting Co.

Our latest major development is in the field of die-casting magnesium, now on a small production basis. Magnesium is the most plentiful metal on earth. It is destined to be the cheapest. It is one-fourth the weight of iron. Social and economic effect to reduce costs and weight of mechanical appliances, permitting greater distribution, greater production and greater employment.

R. J. AITCHISON, president, Fansteel Metallurgical Corp.

Principal contributions of Fansteel Metallurgical Corp. have been industrial developments rather than new consumer articles. One of Fansteel's recent important contributions to industry comprises perfected practical Tantalum heating, absorbing, condensing and cooling equipment for those industrial processes which employ hydrochloric and hydrobromic acid and bromine, thus making these difficult to handle reagents available for general industrial use at moderate cost and with complete reliability.

ALFRED P. SLOAN, JR., chairman of the board, General Motors Corp.

Our research and development program carried out by the various activities of the corporation has resulted in a long list of achievements in the past few years. Among these are metallurgical development, including new bearing materials of copper, lead, cadmium silver and indium. We have also developed a new quick process malleable iron which allows more use of malleable castings. The adaption of powdered metallurgy to productive problems will open up entirely new manufacturing techniques. The large aircraft engines now being built by one of our divisions, may completely change high speed and weight carrying airplane design. In the automobile field, we have made automatic transmission, hypoid gears, steel safety tops, coil spring suspensions and general increased performance, economy and safety.

S. B. ROBERTSON, president, B. F. Goodrich Co.

Supplementing our pioneering of rubber-lined equipment for mechanical operations Koroseal Plasticized Vinyl Polymer offers unique resistance to powerful oxidizing solutions. Its mechanical stability, flexibility and non-flammability adapt Koroseal for electrical installation.

P. W. LITCHFIELD, president, Goodyear Tire & Rubber Co.

During depression years Goodyear's activity in the field of research has been especially intense. Uppermost on our list is the Goodyear Lifeguard, which consists of a tire within a tire. On the reserve air chamber thus provided an automobile may be driven to a safe stop even after the most severe blow-out.

Still another innovation is in our Airfoam, a beaten and molded latex product which offers superior cushioning qualities for automobile seats.

PHILIP D. BLOCK, president, Inland Steel Co.

After a number of years of research we have found that by the controlled addition of small quantities of lead both carbon and alloy steels can be machined 30 to 50 per cent faster. The improvement in machinability is ob-

**IT'S A GOOD DEAL
THAT SAVES
BOTH SIDES
MONEY**

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Die Makers know that Danly Die Sets are accurate in every dimension—there are no added, unpaid costs for further machining, or truing up—no lost time in trying and fitting in mounting the die.

Die Users know that dies mounted in Danly Die Sets give them lower cost stamping in freedom from shearing—accurate and faster production—longer runs between regrinds—and more stampings per die.

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Their Dependable Quality Means Lower Cost Stampings

tained without any sacrifice of other physical properties or interference in susceptibility to heat treatment.

ROBERT C. STANLEY, president and chairman, International Nickel Co. of Canada, Ltd.

Nickel's contribution to the greater convenience of mankind, lies in its participation in the development of modern alloys. With more than 2200 separate nickel-bearing alloys, this contribution is spectacular in the variety and multiplicity of uses which research has found.

JOHN D. BIGGERS, president, Libbey-Owens-Ford Glass Co.

Our industry's major new products follow:

Hitest—A new and greatly improved safety glass. Twice as strong as former product.

Thermolux—A new translucent glazing product, just going into production here, composed of a layer of spun glass fibers sealed between two pieces of flat glass. It offers excellent light diffusion and effective insulation against heat and cold and sound.

W. S. PEDDIE, treasurer, Minneapolis-Moline Power Implement Co.

We do have outstanding products especially built to combat land erosion. We pioneered the development of high-compression engines for tractors using high-grade Ethyl gasoline.

Our most recent outstanding development is the tractor with an all-weather cab known as the Comfortactor.

FLETCHER W. ROCKWELL, president, National Lead Co.

Twenty years ago the development of titanium dioxide pigments was begun by a research group that grew into Titanium division of National Lead Co. Research since 1934 has made its highly concentrated opacity economical and indispensable in many products.

MARSHALL L. HAVEY, general sales manager, New Jersey Zinc Co.

So far as a major product development is concerned, we should like to point out that the zinc alloys used in die castings are the result of extensive industrial research.

It was only after years of testing by the Research Division of the New Jersey Zinc Co. that the zinc alloys were developed.

T. M. GIRDLER, chairman, Republic Steel Corp.

So far as our own company is concerned, we have made great advances in strip and sheet production by installing the largest continuous strip mill in the world.

ALDUS C. HIGGINS, president, Norton Co.

One of the most significant recent accomplishments from Norton company

laboratories is a grinding wheel, the rim or face of which is made of crushed diamonds bonded with metal. The diamond wheel is economically important because it makes possible a wider and more effective use of the cemented carbide cutting tools which are now considered indispensable in lowering machining costs.

ROBERT E. WILSON, president, Pan American Petroleum & Transport Co.

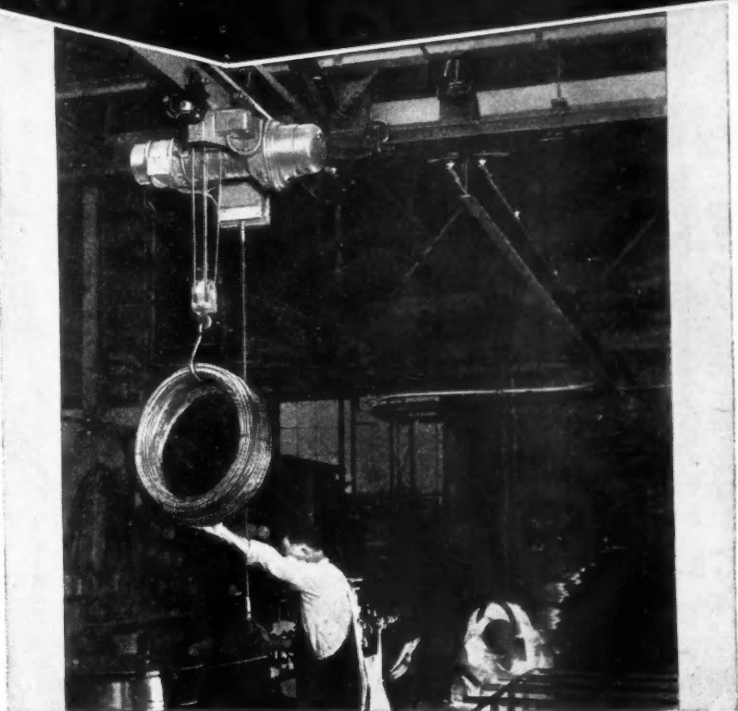
It occurs to me that . . . the most important developments resulting from industrial research in the petroleum in-

dustry during the past three or four years in the probable order of their importance are as follows:

(1) Catalytic Cracking. This, while somewhat overplayed in certain recent publicity, will undoubtedly play a very important factor in the future development of the oil industry and motor cars as well.

(2) The Polymerization of refinery gases into high anti-knock gasoline. Measured by results to date, this is even more important than catalytic cracking and it has greatly increased the amount of high anti-knock gasoline obtainable from a barrel of crude.

P&H HEVI-LIFT HOISTS



GET SPEED AND LOWER COST WITH "THRU-THE-AIR" HANDLING

Off the floor! . . . out of the aisles! . . . "thru the air" handling give you swift, effortless movement of loads — saves money, saves man power, saves time. P&H hoist engineers will gladly recommend the most practical material handling methods for your individual needs. Why not investigate? Or ask us to send your copy of Bulletin H-5? The Harnischfeger Corporation, 4559 W. National Ave., Milwaukee, Wisconsin.

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(3) The use of liquid propane as a refining agent in a wide variety of processes, mainly in connection with the manufacture of lubricating oils.

(4) The manufacture of commercial iso-octane for aviation fuel. This has tremendously increased the speed, load-carrying ability and efficiency of aviation engines.

FRANK T. SHEETS, president, Portland Cement Assn.

The Portland Cement Association after three years of basic research has developed soil-cement roads, the new answer to the light traffic road prob-

lem. Extensive laboratory research has developed the basic principles of combining natural roadway soil and Portland cement, to produce durable, weather-resisting material at low cost for light traffic roads.

FRANK A. HOWARD, president, Standard Oil Development Co.

Under the pressure of applied science brought to bear through industrial research, petroleum and natural gas are now becoming the starting point for limitless new synthetic industries. Standard Oil Co. (New Jersey) interests have just put into operation two

large plants which are examples of, and which pioneer, the new synthetic processes.

F. E. SHLUTER, president, Thermoid Co.

Our specially woven rubber-backed automobile carpet was developed for the automotive industry, meant the creation of an entirely new division of our company activities, used looms made idle when brake lining changed largely from woven to molded, created 100 new jobs in our company.

JACK FRYE, president, Transcontinental & Western Air, Inc.

Application of ultra-high radio frequencies to two-way communication between ground and aircraft is a major development of type you describe. Five months of operational test of two-way communication equipment on 125,000 kilocycles between Pittsburgh and New York just completed by TWA in cooperation with Bell Telephone Laboratories shows these frequencies provide perfect communication under intense thunderstorm and so-called precipitation static conditions.

D. L. BROWN, president, United Aircraft Corp.

United Aircraft Corp. developing entirely new types of aircraft powerplants of large output. These will enable military aircraft to attain superior performances and provide adequate power for super-bombers and giant boats.

ELMER ROBERTS, vice-president, United States Rubber Products, Inc.

Latex Foam Sponge: A revolutionary development of U. S. Rubber laboratories—latex foam sponge—has perhaps the greatest potentials.

Cellular Hard Rubber: Unlike the ordinary sponge or the revolutionary foam sponge described above which has interconnecting cells, the cellular hard rubber mass consists of an enormous number of non-interconnecting cells. This characteristic makes it a highly efficient thermal insulation. It is water-proof and vapor-proof.

Microporous Rubber Products: By an entirely different process than those used in the production of latex foam sponge or cellular hard rubber, a new type of rubber sheet has been produced having a high degree of porosity. One form of the material is now being used extensively in the manufacture of storage batteries.

Safety Tires: The continuous development of improvements in automobile tires.

FRANK PURNELL, president, Youngstown Sheet and Tube Co.

A recent product of Youngstown research is Yaloy steel, a nickel-copper high tensile steel. Since the use of Yaloy is indicated in numerous industries such as railroad, automotive, transportation, oil and fabricating, its importance in our present social and economic era is pronounced.



Molded parts from Bay Manufacturing Company

It's PRETTY HARD to get all steamed up over a little thing like an automobile horn button. But you'll have to admit that the Durez buttons shown above are just about the smartest looking jobs that ever graced the top of a steering column!

You'll find them this year on many leading makes of cars—harmonizing happily with color schemes, giving new safety and convenience, resisting all wear and tear. And with them you'll find control knobs, interior trim, even instrument panels—all made of this modern plastic.

Because Durez is adaptable to any design—because Durez parts can be formed and finished in one operation—leading car manufacturers have standardized on this material for many molded parts. If you would like to know more about Durez, write General Plastics, Inc., 94 Walck Road, North Tonawanda, N. Y.

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DUREZ *Choice of the Automotive Industry*

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.
Volume 80 May 15, 1939 Number 18

WE meant to mention in our last issue that the work in changing the appearance of our feature presentations which accompanied our switch to semi-monthly publication, was tackled and well executed by one Mr. Vernon Sisson. We stake no claim as discoverer of Mr. Sisson's talents, for his work has appeared at Printing for Commerce shows, at the American Institute of Graphic Arts and at exhibitions of Art Directors' clubs both in New York and Philadelphia.

Mr. Sisson studied art at the Commercial League of Art Students under Charles Noel Flag. Equipped with talent, knowledge and ambition, he departed to obtain his first job. This he secured in the studio of a free-lance litho artist, where he spent his time inking engravings, delivering stories, making simple sketches for hardware labels and, as he says, practicing alphabets for years and years—with no pay. Success was in the offing, however, and he was soon earning \$15 a week in a Massachusetts lithographer's shop.

A period of years, a variety of jobs, then came the war. Joining the army in 1917, Mr. Sisson saw service in Washington in making illustrations for the "Medical History of War," under direction of the Surgeon-General's office. The end of the war, however, found him in the Brady Laboratories at Yale doing experimental work with war gases on dogs.

Leaving the harassed dogs in his wake, Mr. Sisson hurried to Philadelphia at the end of hostilities. In Philadelphia he remained, opening his own studio in 1923.

Mr. Sisson tells us he has no choice of specialty in the design field. Obvious, perhaps, when we note that his activities extend to the design of machinery, screwdrivers, liquor bottles and, so help us, baby incubators.

GENERAL

New Records Expected at This Year's Indianapolis Race

Page

593

—And Louis Schwitzer tells us why. A brief look at a few of the cars now being readied for the Memorial Day classic.

Heldt's "High Speed Combustion Engines" Goes Into Tenth Edition

610

The tenth edition of any book is indicative of wide popularity and intrinsic value, particularly in technical publications. The author of the book, dean of automotive editors and engineers, is also, we proudly confess, AUTOMOTIVE INDUSTRIES' Engineering Editor.

MATERIALS

It's Control All Along the Line

596

The modern manner of making precision felt components which must meet the stiff specifications set by the automobile manufacturers is told by H. E. Blank, Jr.

New Developments in Automotive Materials

601

RESEARCH

Cathode Ray Engine Indicators Have Advantages

612

Their popularity has been growing due to their suitability for high speed and the convenience of direct visual observation. C. H. Schweitzer discusses the new method of calibrating instruments.

New Process for the Production of Aviation Gasoline

618

TRANSMISSION DESIGN

Transmission Designs Combine Hydraulic Devices with Mechanical Drives

614

Three types manufactured by the Szekely Co. are discussed in detail.

Bendix-Westinghouse Automatic Clutch Control

617

Business in Brief

595

Just Among Ourselves

603

Men and Machines

604

Production Lines

606

1939 Pontiac Six Engine Drawing

607

Chilton Round Table

623

News of the Industry

625

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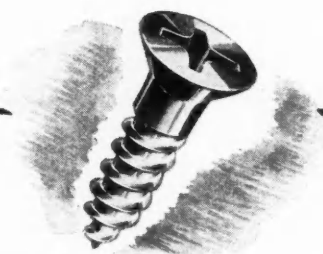
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To the man who has yet to buy his first PHILLIPS SCREW



IF YOU were the type of man who loves to putter around a home work shop, you would have been enthusiastic long ago about the Phillips Recessed Head Screw.

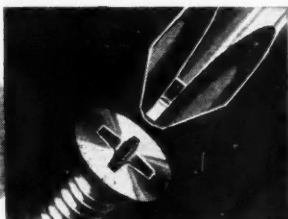
It really takes all the work out of screw-driving. The screw clings to the driver . . . you can start it with one hand, even without a pilot hole . . . it goes in straight . . . the driver can't slip out and gouge whatever you're fastening . . . and it turns as easy as a faucet.




Now suppose you take the time a man saves putting up a shelf in the pantry and multiply that by the number of screw-driving operations you have around your plant. When you realize that manufacturers in all branches of industry have cut assembly costs an average of 50% just by changing

to Phillips Screws . . . you'll get an idea of what to expect in your own plant.

Add the stronger assemblies you get . . . the freedom from burrs and split heads . . . the improved appearance—and you've got something that you really ought to look into. There's money for you in that Phillips recess!

So here's what we suggest you do. Write today to one of the Phillips Screw manufacturers listed below . . . get all the facts or, better still, send a trial order . . . try driving them into a piece of wood—or watch one of your men use them on sheet metal or metal assemblies. We'll bet that when you visualize the savings that could be effected throughout your entire plant . . . you'll agree that *it costs less to use Phillips Screws.*



-  **MACHINE SCREWS**
-  **SHEET METAL SCREWS**
-  **WOOD SCREWS**
-  **STOVE BOLTS**

This Booklet will help your plant to cut fastening costs and improve assemblies.

Address one of the firms below for free copy.



PHILLIPS RECESSED HEAD SCREWS

U. S. Patents on Product and Methods Nos. 2,046,347; 2,046,837; 2,046,839; 2,046,840; 2,082,085; 2,084,078; 2,084,079; 2,090,338.
Other Domestic and Foreign Patents Allowed and Pending.

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